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Wednesday, June 7, 1882.

ADMIRAL SIR EDWARD G. FANSHAWE, K.C.B., Member of Council, in the Chair.

DISCUSSION ON THE PRIZE AND OTHER ESSAYS

ON "THE BEST METHOD OF PROVIDING AN EFFICIENT FORCE OF OFFICERS AND MEN FOR THE NAVY, INCLUDING THE RESERVES."

The CHAIRMAN: The subject of the essays covers a great deal of ground, and therefore a memo. has been prepared, pointing out the chief topics that have been touched upon in them. I would ask gentlemen to discuss those points as closely as possible, and to speak on the whole subject in one speech before they sit down.

PROPOSED POINTS FOR DISCUSSION.

The Age and Method of Entering Naval Cadets.
The Training and Education of Junior Officers.
Selected Promotion of Sub-Lieutenants and Commanders.
Permanent Appointments of Captains and others to large Ironclads.

Method of Recruiting.
Should the Age of Boys at Entry be Increased?
Inferior Physique of many of the Boys.
Extreme Youth of our Ships' Companies.
The advisability of entering a certain proportion of older Boys, of Men, and of Men from the Second Class Reserve.
Training and Education of Boys.
Establishment of Naval Barracks.
Abolition of the Special Class of Seamen Gunners.

The Numerical Strength of the R.N.R.
The Dependence to be placed on the Merchant Service in time of war.
Increase of Coast Guard.
Enrolment of Fishermen.
Volunteer Torpedo Corps.

Vice-Admiral LUARD, C.B.: You will observe that the first points in the programme, alluded to by our Chairman, proposed for discussion this afternoon, are the age and method of entering naval cadets, and the training and education of junior Officers; and as I happen to have been present at the lecture so opportunely delivered

Fig 1.
Plan of a Prussian Fort
A. D. 1825.

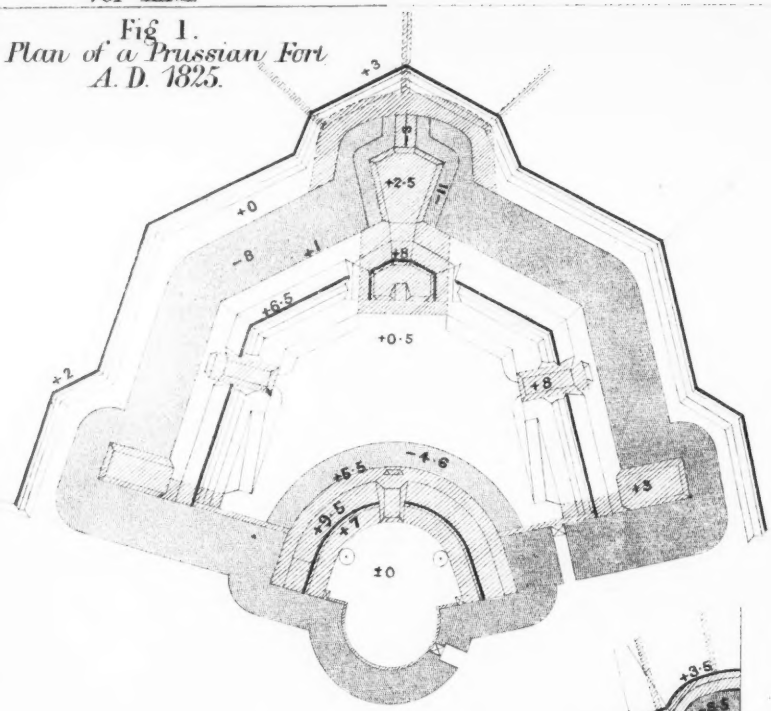


Fig 2.
Half Plan of a Pruss
A. D. 1875.

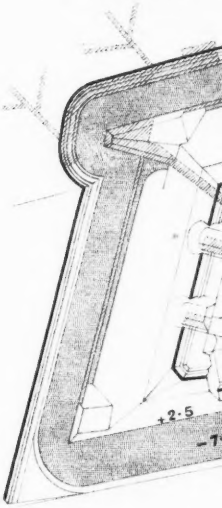


Fig 4. *Half Plan of a Fort.*
(from Wagner)

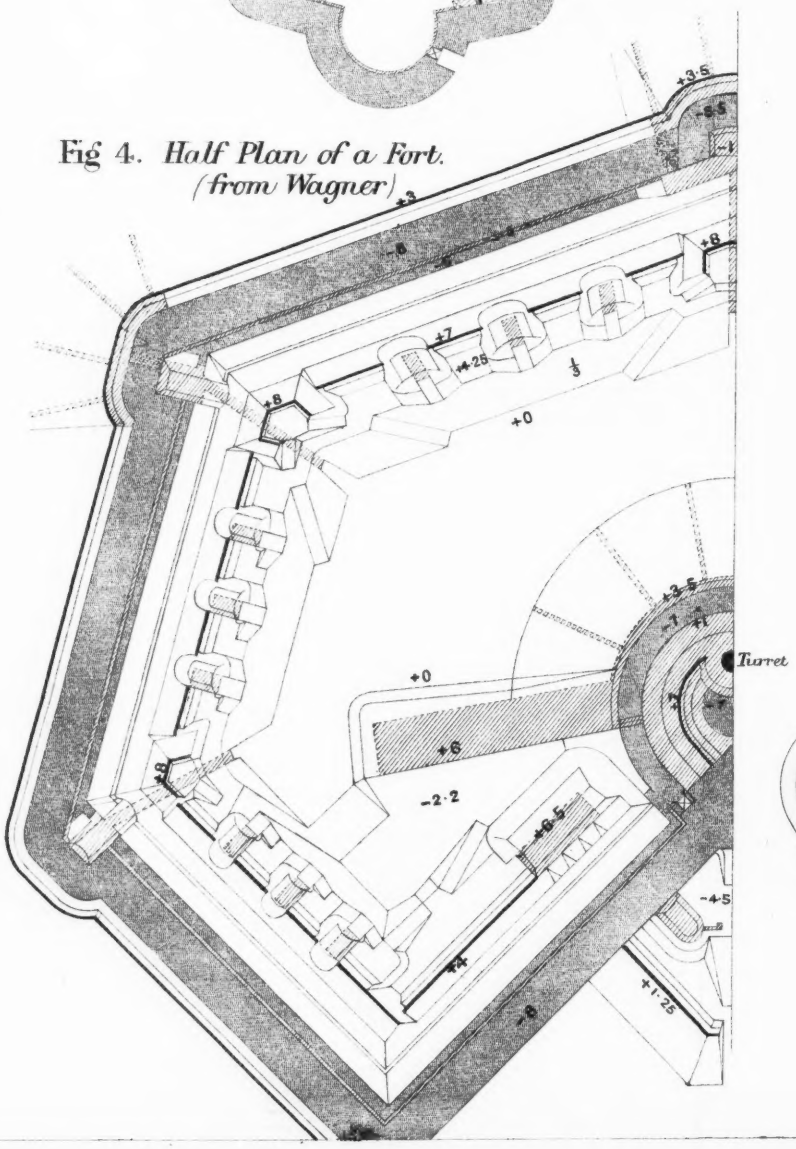
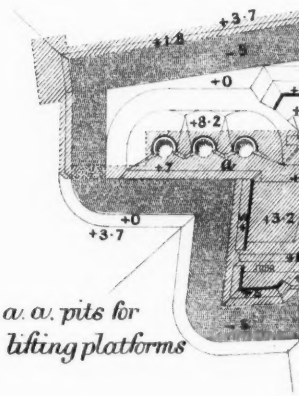
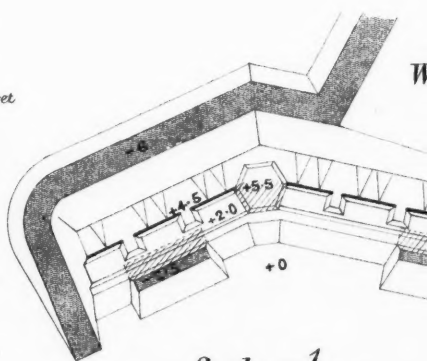


Fig 5. *Plan of a Fort*





Scale, $\frac{1}{2{,}000}$.
Reliefs in métres,
+ above, – below, the ground
Casemates shaded.

Fig 2.
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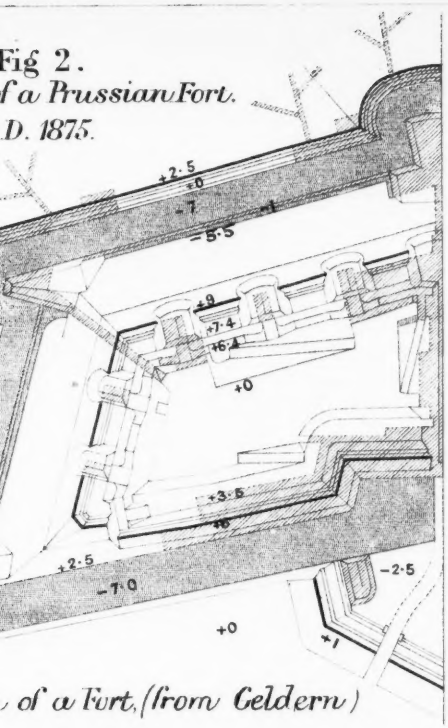
D. 1875.



of a Fort, (from Geldern)

Fig 3.
Half Plan of an Austrian Fort

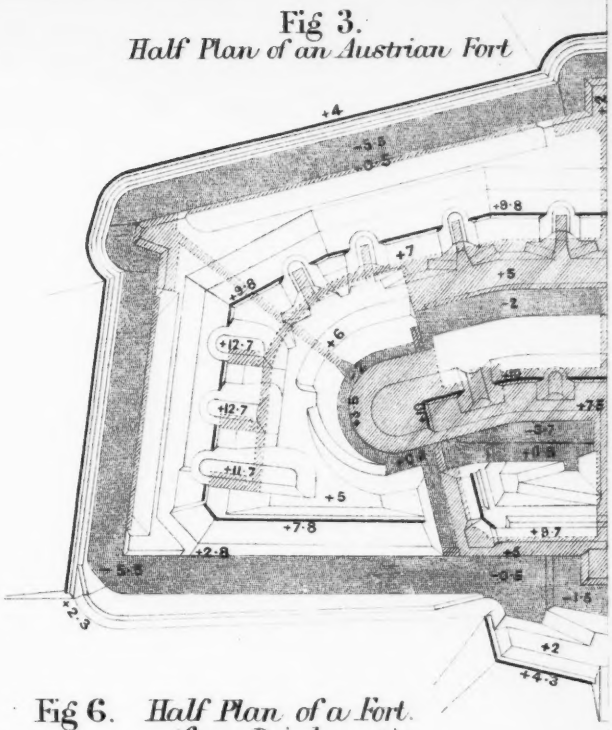
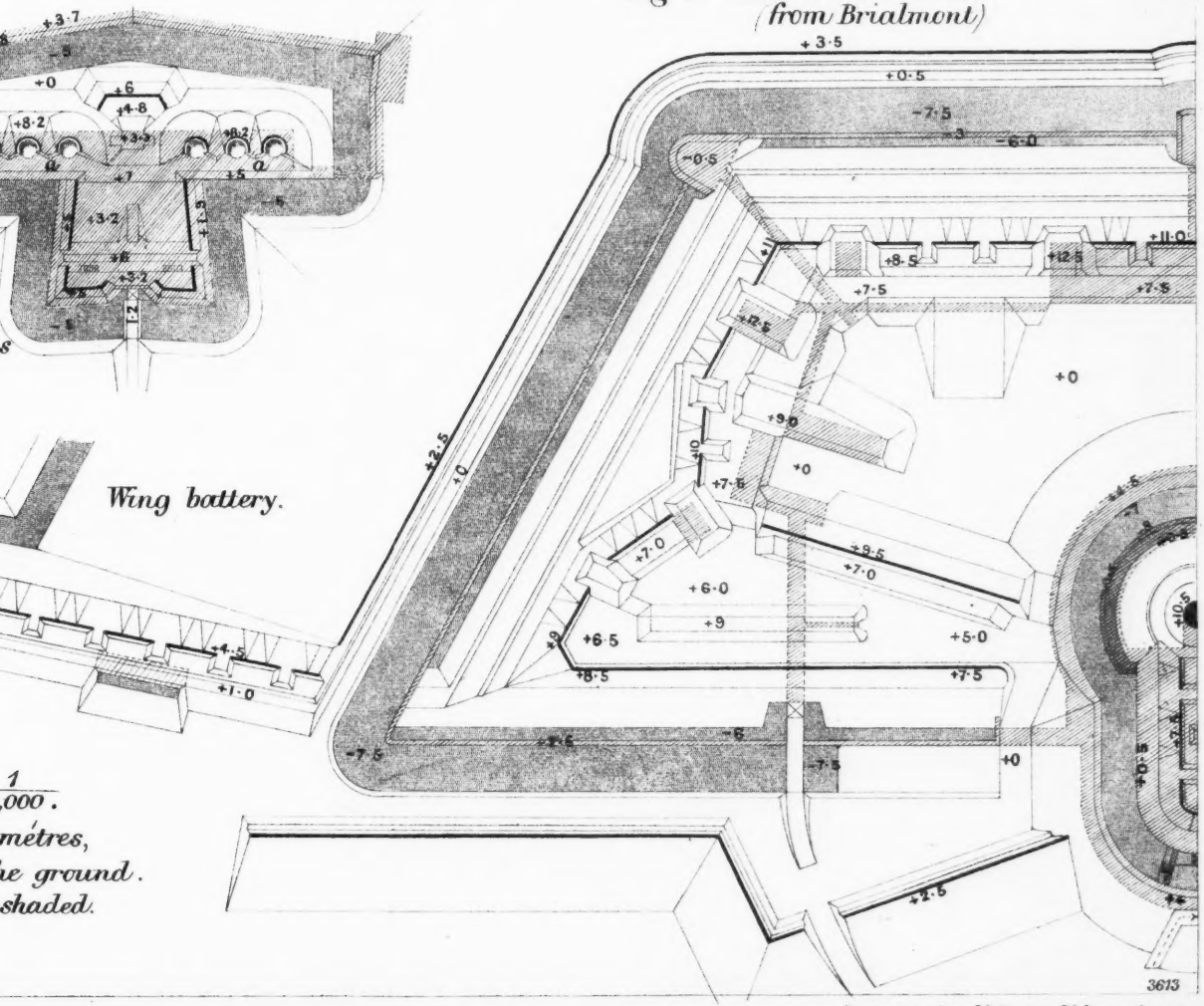


Fig 6. Half Plan of a Fort.
(from Brialmont)



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DANGERFIELD. LITH 22 BEDFORD S' COVENT GARDEN

by Mr. Laughton, on "naval education,"[1] just before these essays were printed, I should be glad to offer a few remarks on that subject. As our time for discussion is short, I will confine my remarks entirely to the points I have referred to, which are common both to the essay and to the lecture, and it may perhaps be convenient, first of all, to compare some of the views of the essayists, and afterwards to consider the lecture. Captain Lindesay Brine, who, I think, may well be congratulated upon having written the essay which carried off the prize, declares: "The history of the training of our young Officers has been for the last fifty years a series of endeavours to fit in the new requirements of the Service with the traditions of the past. To a great extent we have been building upon old foundations, and the results have not been satisfactory." Commander Grenfell says: "The question of entry and training of naval cadets is one which has given rise to a considerable amount of discussion in the Service. Standing on the very threshold of any consideration as to the efficiency of the Officers of the Service, the problem of giving a suitable training to our young Officers is one which affects the whole tone, discipline, and efficiency of the Service in the highest measure. The present system stands condemned by an overwhelming mass of opinion, both as to its scientific results, and also, in a higher degree, as to the standard of practical knowledge of seamanship which it produces." So that in point of fact there is a practical agreement between these two essays as to the result of our present system of training and education. But when we come to compare the proposed remedies, there is a very wide and entirely irreconcilable diversity of opinion between all the essayists. Captain Brine considers that—"Instead of the present Regulations, it is proposed that the age of examination for entry shall not be less than fifteen and not exceed sixteen and a-half. The training on board the 'Britannia,' or at a naval college, should continue for three years, and in every year the summer months might be occupied in studying practical seamanship in a training vessel at sea. At the expiration of this time, the cadet should pursue a special course of training in gunnery, steam, torpedoes, and such elements of naval construction as are connected with the special requirements of modern warfare. Upon the completion of this course, and at an age not less than nineteen, the cadet will be eligible for examination, which would be final with respect to mathematics." Now, I think the objections to these proposals are, first, that the actual experience at sea would commence far too late; and that the idea of making the examination with respect to mathematics *final*, when the cadet first qualifies for a Sub-Lieutenant, can hardly be seriously entertained. Commander Grenfell says: "As a matter of fact the two things" (speaking of practical seamanship and scientific instruction) "are incapable of association. With the early entry as it is, and the examinations as they are, all that was most valuable in the old methods of training is starved out. Seamanship in its real sense must go to the wall, and does go to the wall to an extent which I believe is becoming a positive danger to the position of the Service. There is no escaping the facts of the case. If our naval supremacy rests on our capabilities as practical seamen, and if this supremacy is to be maintained, the present system of early entry must be given up. The rough work of general education must be completed in some way or other before boys come to sea, and when they come to sea their training as Officers and seamen must be undivided, continuous and thorough." And then he goes on to say: "I should be inclined to fix the age at sixteen or sixteen and a-half, at which boys should pass out of the Naval Training College and go to sea, and thenceforth I should make their training and examinations strictly professional. But, I think it highly desirable that boys should commence their preparation for the Navy at quite as early an age as they do at present, and nominate them at twelve for entry into the Naval College." But here, again, the old difficulties with respect to the first nominations to the Naval College would immediately recur; and I am strongly of opinion that it is not at all desirable to shunt boys at the early age of twelve into any special groove. Now, Lieutenant Campbell takes an entirely different view, for, after quoting Lord Northbrook's speech in the House of Lords last year, he says: "With this weight of evidence we will leave the question of 'later entry' and 'Britannia' as having been passed by the mass of the initiated, with a favourable verdict for the present

[1] *Vide* Journal, No. CXV.

system, improved in detail, into the category of decided issues. We, however, advocate, as a change in detail, a third year in the 'Britannia.'" Now, it appears to me that the addition of a third year to the training in the "Britannia" would rather increase than diminish our existing difficulties: and I very much doubt if any of the Officers who have been actually entrusted with the execution of the duties on board the "Britannia" as a training ship could be found to join with Lieutenant Campbell in his advocacy of such an extension. Sub-Lieutenant Tupper says: "It would, I think, be a great pity to enter the cadets at a more advanced age than at present, because as a boy gets older he learns to appreciate the comforts of a home, a room to himself, and the hardships which fall to the lot of a midshipman and Sub-Lieutenant would seem all the harder to him because he had been longer accustomed to luxury. The consequence would be that he would become discontented, and soon desire to leave; therefore I say let the age of entry remain as at present. Not very long ago it was almost resolved to throw this branch of the Navy open to public competition, but I am glad to say we have not yet arrived at that. I fail to see what benefit would be derived from such a proceeding as long as we can get a sufficient number of boys, sons of gentlemen and Officers who have served their country, who pass the standard required." Now probably if Sub-Lieutenant Tupper, who certainly deserves considerable credit for this essay, had previously had the advantage of reading Professor Soley's somewhat ironical remarks quoted by Lieutenant Campbell, upon our system of entry and training, he would hardly have alluded so pathetically to the hardships which fall to the lot of midshipmen, or spoken so very confidently as to the desirability of retaining nominations without any competition. But, Sir, there are some statements in Commander Grenfell's essay which I think ought not to be passed over without a very strong protest. Commander Grenfell asks, "What is the earliest age, consistent with attaining a fair standard of general knowledge, at which we can start a lad into the practical work of his profession? And what is the latest age at which a boy can actually go to sea with a hope of acquiring those seamanlike habits and instincts which are all-important? The alternative is a difficult and a hard one; but I, for one, if anything is to be sacrificed, would rather give up some portion of the standard of scientific culture which could be reached. I do not refer to the present standard, because that is admittedly very indifferent, but to that which could be reached by keeping lads at their studies till seventeen or eighteen. Of the two, I do not think we require a very highly educated body of Officers." Now, on the other hand, I venture to maintain not only that we require a very highly educated body of Officers, but that it is absolutely essential to the efficiency of our Service that we should possess them, and that it would be fatal to our prestige as a great naval Power, and might even endanger our very existence as a nation, if we fail to obtain them. The alternative Commander Grenfell puts before us is certainly a difficult and hard one, but that is the very problem we have to solve. It requires, no doubt, to be dealt with in a vigorous and comprehensive manner, but surely we are not prepared to admit that it is incapable of solution, or to agree with him when he says further on, "I fail to see how high scientific training can be combined with thorough instruction in practical seamanship." I think that is a statement which ought not to go forth to the country unchallenged. Again, he says in respect to entry and training of naval cadets, "If the lads are not the *élite* of the boyhood of the country, they are at all events of the class we want, and have the making of good Officers and seamen in them." No doubt they have; but with the immense desire which exists throughout the country on the part of its boyhood to go to sea, and to become naval Officers, I believe it depends very largely upon our method of entering cadets whether we obtain that *élite* or not; and if we fail to do so, it is entirely our own fault. We certainly want, and must have, the very best material that can be got, from which to manufacture our future commanding Officers; and, unless we are prepared to accept a very much lower position in the great array of nations than we have hitherto so proudly asserted, and always gloriously maintained, we must find the means to obtain it. The hands of the clock warn me that it is already time to leave the essays, and pass on to Mr. Laughton's lecture. With respect to that lecture, I would beg permission to read a few observations, written immediately after it was delivered, so that they are entirely unbiassed by any of the views

in the essays we have just been briefly discussing. Now in his opening remarks Mr. Laughton gives full credit to all the Officers at the College for desiring to profit by their different courses of study, and states with respect to the gunnery and torpedo classes that they develop and maintain an unusual power of work; and also that after a short period the Sub-Lieutenants display very earnest application; yet he considers the results can only be called "fairly satisfactory." The reasons for this extremely disappointing conclusion are, in the opinion of the lecturer, distinctly attributable to a general want of preparatory knowledge on the part of the Officers before joining the College, and a special lack of the study of mathematics; and notwithstanding the state of things at present is unquestionably better than it was at first, *elementary* instruction in mathematics still occupies the greater part of the time at College. The paragraph of the lecture which sets forth Mr. Laughton's idea of the standard of mathematical knowledge that might reasonably be required before any Officer was allowed to commence his studies at the College, and the proposal to establish an "advanced course" for those of exceptional ability, who might wish to prosecute their work into *higher* mathematics, will probably meet with general approval; and, although we may not be prepared to endorse his views with respect to the present arrangements for manufacturing and supplying the armaments of our ships, yet no doubt one of the outlets for Officers who had successfully passed through the "advanced course" would be in connection with the designing and construction of naval ordnance, while some might also find congenial employment in surveying and other cognate duties. But the lecturer then brings us back to the original difficulty, which blocks the way to the attainment of any such results, and compels the verdict only "fairly satisfactory," to all the efforts hitherto made for the promotion of naval education, namely, that the bulk of all time spent at the College is of *necessity* devoted to the most elementary mathematics, and he asks, "Is it possible to do away with this necessity?" The answer to this question is of vital importance, for in that answer must be embodied decisions of great moment; and I think it incumbent upon us, first of all, to state explicitly whether we believe the present system of very early entry of cadets, and their training in the "Britannia" with final discharge as *Officers* into ships in commission, has answered the purpose for which it was instituted, or can be expected to ensure the combination of practical seamanship and scientific knowledge, now more than ever necessary for the first formation of a naval Officer's professional character, and his actual fitness for eventual command. Judging from my own experience, and from various published reports, I cannot so regard it; and reluctantly, but decidedly, record my opinion that this system no longer meets the requirements of the day. From this point of view, then, let us now consider the suggestions of the lecturer:—First, as to the age and method of entry of cadets; secondly, as to their subsequent training. The proposal to enter cadets directly from public or private schools from ages varying from fifteen and a-half to seventeen, would, if adopted, almost solve two questions, for it would remove the grave objections to open competitive examinations which attach to its application when the boys are so much younger, and it would practically decide the fate of the "Britannia;" for it would be extremely undesirable, if not impossible, to retain lads over sixteen for a further period of two or three years in a stationary harbour ship. Why then should these suggestions not be adopted? The answer generally will be, that a lad of sixteen or seventeen does not so readily adapt himself to a seafaring life as those who commence earlier; and also that he would not have had sufficient actual experience at sea to qualify him for the rank of Sub-Lieutenant at the age prescribed by the "Queen's Regulations." The first objection really carries no weight, for the reverse is equally likely to be true. The second requires more consideration, and possibly some modification of the Regulations. The real objection, however, appears to be, that lads entered at that age would be too old to be dealt with in the "Britannia," and to adopt this age would undoubtedly necessitate the abolition of the "Britannia," and consequently the substitution of some other system of training. Are we prepared to recommend such a change? And if so, what system should be instituted for the future training of naval cadets? My own opinion is, that the time has fully come when we ought to make this change; that the feeling of the Service would be favourable to it; and that it would be

thoroughly approved by the country at large. The future training of our cadets after entry by open competition at from fifteen and a-half to seventeen would then perhaps resolve itself into a choice between a certain time at a college on shore, or a similar period in a *thoroughly sea-going training ship;* and there will be few sailors, I imagine, who will not hold up their hands for the training afloat. It cannot be supposed that such an entire change would be undertaken at all without the most mature deliberation; and after our sad experience with training ships, it will require more than ordinary firmness and determination successfully to accomplish the alteration; but if it is once conceded that the result would, to the best of our judgment, benefit the Navy, and therefore strengthen the country, we have still, thank God, statesmen and seamen equal to the task.

General SCHOMBERG, C.B., R.M.A.: I begin by stating my opinion—whatever its value may be—of the very great ability displayed by all the essayists. I think the only head in which they rather fail is this: all the political events around us point to the almost certainty of a struggle for the command of the sea before very long; probably before the century is over; and I do not think their words are weighty enough to point out how serious our preparations should be for that struggle; which will not be for empire, but for existence. On the training of naval Officers I would venture to say but very few words. I think in the training of all Officers that we should remember that we certainly want scientific men,—one important function of such scientific Officers being to prevent complication of mechanical means in war; in that function, our scientific Officers appear to me to have failed of late years: we want scientific Officers, but we do not want *all* Officers to be scientific: we want ready working men. Now we have a magnificent material for making Officers;—do not spoil that material by trying to accomplish too much. It is impossible to make an average Officer a sailor, a navigator, a torpedoist, an electrician, an artilleryman, a military engineer, a steam engineer, an infantry soldier, an artillery soldier on shore; to give him besides *all* this a knowledge of military and international law, and of a language or two. It is impossible to obtain such a result as this, and you will spoil a very magnificent material by attempting it. Modern arms require more than ever the greatest care in handling them; they require the perfection of training in those who handle them; every Officer should be perfectly trained to the special arms to which he belongs. For instance, if torpedoes be placed in the hands of amateurs, the only possible result will be disaster. With regard to the men I will not venture to say much. I will only repeat a few words which I believe I said in this hall a few years ago: I think the men composing our Navy are truly magnificent. I suppose they are men of the highest education of their class in England or the world. Such men must be governed by an iron, but judicious, discipline: they must be taught to obey without a question. Their education is in the hands of their Officers from their very youth; their Officers are answerable for their discipline; I have no doubt the result will be all that can be desired. With regard to the reserves, I am of opinion that they are at present inadequate for the struggle that may be before us. I first of all begin with the 17,000 Naval Reserve. No doubt they would be most valuable in case of war, but we cannot count upon them as our first reserve. Half of them would assuredly be absent on a sudden outbreak of war, and the other half be half-trained. Then there are three or four thousand Coast Guards who are admirably trained. I see the Prize Essayist gives credit to the Marines for 6,000 as reserves. He takes the Marines at 12,000, 6,000 embarked and 6,000 on shore. I am sure I am overstepping the mark when I say you cannot reckon on over 4,000 as reserve; you must subtract instructors—men under instruction, besides the sick. The main argument for retaining the marine force is that it is a school of instruction; and I think 4,000 is the very outside of the reserves that you could at present expect from the Marines. I see the Prize Essayist also proposes to retain the Marines, "as one of the main elements of the Standing Reserve." It is my duty to say that under present conditions I do not think the Marines will exist many years. The service will break down for want of good Officers. Formerly we held our own by having a superior educational test. The Officers of the Marines had an educational test long before the line had; and the examination passed by Marine Artillery Officers would then have carried them into the Royal Engineers; but

all this is changed by the abolition of purchase, and I cannot help saying that the Officers we are now getting are those who fail for the artillery and line. Now if the competitive test be any test at all of the value of Officers, the end of this will be that we shall get inferior Officers. I do not wish to wound the feelings of Officers joining now, but if competition be a test of the value of Officers, the only result must be that the Marines will be commanded by inferior Officers. I daresay you may think that with inferior Officers you will still get the men equally well trained; but I tell you it is impossible. You have no idea of the care, zeal, and intelligence that have been employed in training the men of the Marines. It is no mean feat to take a lad from the midland counties who has never seen a ship, and send him on board ship fully equal in artillery training to the seaman gunner who had been bred as a sailor; and if that task fall into the hands of inferior Officers you will not get the same result. I have had experience of many Officers in my time, and those Officers who have planned and carried out the instruction of the Marine Infantry and Artillery are as good Officers as are to be found in any service in the world, though unknown to fame. If you wish to retain the Marines you must make an entire change in their employment; one change I propose will be to fall back on the proposition of the Committee, quoted in the essay, to increase them by 5,000 men. The Commission proposed to employ these men in English seaports, but I would employ them abroad—at Malta, Gibraltar, Halifax, Bombay, or Hong Kong: at each of these ports should be stationed a battalion of Marines, and a detachment of Marine Artillery, where the men would be more useful as reserves, and the Officers would be better trained and more usefully employed than in English seaports. On reading the prize essay, there are two passages which appear to me especially striking. One is Sir Byam Martin's quoted opinion: "That it is not within the compass of human contrivance to light upon any scheme equivalent to impressment as a means of bringing the seamen together with the rapidity which a general armament must ever require." The Commissioners on that say: "When, however, everything shall have been done which prudence can suggest to furnish in time of peace reserves available on the outbreak of war, there will still remain, as a last resource, your Majesty's undoubted right to the compulsory service of your Majesty's subjects, by sea as well as by land, in case of actual danger to this country." I think that is one fact we should never lose sight of. We should never lose the power of compulsory service, either in the Army or the Navy. Another paragraph which seems to me most important is the author's remark: "In the investigation of the supplies of men, it is necessary to avoid being misled by theories with respect to the numbers that should constitute our reserves. In no branch of inquiry is it so essential to be strictly guided by not only what are the numbers available, but also what may be practicable." I think that is well worthy to be written in letters of gold. Finally, I cannnot help thinking that our reserves are not adequate for what may be required. In the event of such a struggle as I have hinted at, every ship would have to be commissioned; all the crossings which Captain J. C. Colomb alluded to in his pamphlet on "Naval Intelligence and the Protection of Commerce in War" would have to be swept; you would require many more men than you could possibly get by your present means; and I think that that statesman would not only be a great statesman, but an economical one, who would place the Navy in such a position that it would be irresistible: I believe this can be done.

Admiral Sir F. NICOLSON: I think I may just ask one question which may perhaps tend to clear up the discussion as to the very important point of the reserves. General Schomberg has dwelt so much on the inadequacy of the reserves that I wish to ask him, "Have you compared the number of men available—Coast Guards, Marines, and Naval Reserve—with the number of ships we actually have to put them on board of?" In the olden days we had a great many more ships than men for them. The question then I want to ask, as you have turned your attention to the subject, is, "Have we not now a larger number of men in the reserves than ships into which to put them?"

General SCHOMBERG: I think not, because I read in the daily papers that we have more than 200 merchant vessels *told off for* men-of-war when required—in addition to the ships of the Royal Navy.

Sir F. NICOLSON: I mean ships of war.

General SCHOMBERG: I think, if I may believe all I read in the papers, that those 200 ships may be regarded as part of the Navy in case of war.

Vice-Admiral BOYS: Sir Edward Fanshawe and Gentlemen,—The points that are proposed for discussion are very numerous, and no doubt are the right ones and ought to be discussed. I propose only to touch upon some of them as briefly as possible, because I know that there are many other gentlemen here who can throw light on the subject before us, and I should be very glad to make room for them. At Mr. Laughton's lecture I had the opportunity of recording my views with respect to the age of entry of naval cadets, and I said then that at the present moment, and in the present condition of the Service, there is no necessity for entering youths for the Navy under the age of sixteen. I will not go ever the ground again, but I may say I think it would be better that the country should not educate them, that they should receive a good general education from their friends, and that sixteen is quite time enough for them to go to sea. I would then propose to put them in special training ships, and I believe about sixteen would be the best age for that purpose. As to the method of entry, I should certainly not propose a competitive examination solely; I consider it should be a test examination, and the boys should be entered by the old rule of giving a nomination to Captains of ships when commissioned. Many Officers now lose the opportunity of bringing their own sons into the Service. In any other profession, such as the law, or the medical, or the Church, a father can bring up his son to his own profession, but by the strictly competitive system, naval Officers are to a great extent debarred from doing so. With regard to the "Britannia," in my view that vessel, as an educational establishment, is not a success. I can give you several reasons. I am rather inclined to go with Professor Soley, that although we have several good and promising young Officers, I think they have risen almost in spite of their training instead of as the result of it. I think we should have a great many more of this class if the system were reformed somewhat on the lines that Admiral Luard has given us. I will tell you why I think in the first place the "Britannia" is not a success. The perpetual change of Captains is against it. Mind, I am not giving any personal opinion respecting any Officer who has ever been in the "Britannia;" I merely make my remarks with regard to the system. The Captain of the "Britannia" when he is appointed is not sent there for his own convenience, or as an ornament; he is presumed to have some views of his own, and he will carry on the established duties according to his own principles and ideas. Now no private educational establishment could exist if the head of it were changed every three years, and a new system adopted. The instructors remain, but they do not have the disciplinary dealings with the boys. An instructor in the "Britannia" takes a boy and carries him through the whole of his career of study while on board, but the Lieutenants who regulate the discipline are continually being changed for some reason or another. I would also refer to the ages of the boys. The boys of the "Britannia" are mostly between the ages of thirteen and fifteen. I once heard the head master of a public school, who is now a Bishop, say that there is no more cruel and unfeeling animal than a boy of from thirteen to fifteen. When they are younger they are easily led, and when they are older they are in a position to lead. The captains and prefects of public schools are certainly over the age of fifteen, and they are selected for their own high position and tone in the school, and they make good leading boys. In the "Britannia" that cannot be the case. The minor discipline is arranged for by the system of ship's corporals, which is very irksome and irritable to a large proportion of high-spirited boys. I know some of them: I have been connected with the boys of the "Britannia," and I believe that what is sometimes reported misconduct is very often nothing but thoughtlessness. They get an idea into their heads of dodging the corporals, and the corporals dodge them; they get reported, and then they lose heart and will not try to do their best; consequently they lose a certain amount of time on leaving, and the Service loses too. I quite agree with the majority of naval Officers that seamanship is the important point of a naval Officer's training—not exactly the sailing of a ship, but the qualifications, as we understand them, of a seaman, which are certainly ready resource, strong determination, and prompt decision. Those are the main points which

arise from what is termed seamanship. Now with regard to the seamanship examination on the class of which, at this very moment, so much depends, it is principally an oral examination. Ship-keeping is part of a seamanship examination, but I do not think it ought to be. I do not say it is not a necessity, but I should put it more under the head of navigation than seamanship. What I should propose with regard to the examination in seamanship, as undoubtedly we must come to sea-going training ships for Officers and men, is, that when candidates for Sub-Lieutenants come to the age determined on, they should be sent to those vessels for so many months; they should be placed in charge of the ship, the Captain or other selection Officer overlooking only. The candidate should be ordered to manœuvre the ship under sail or steam, to put her about, lower a boat at sea, pick up a dropped life-buoy, &c.; if the ship gets into irons he must get her out again without assistance, the Captain only interfering to prevent accidents. His class certificate for seamanship should be awarded from capability and style of "carrying on." I can give an instance of a candidate who was rejected for seamanship at a home port; he was sent to the Channel Fleet for three months. At the end of the time he came before other examiners who were certainly well known seamen, and they could not puzzle him; he seemed to be up to everything, and they had to give him a first-class certificate. I only mention this to show the uncertainty of the existing system of classing the examination in seamanship. With regard to the permanent appointment of Captains and others to large ironclads, I confess I see no necessity for a permanent appointment at all. It would not be fair to put a Captain into a ship and send her to fight an action at once, but a man accustomed to handle ships, after a cruize or two knows his ship as well as he is ever likely to know her. With regard to the extreme youth of ships' companies, and the inferior physique of our boys and seamen, a subject on which I see Captain Brine dwells particularly, and I think it is a fact, I have observed even in passing seamen in the streets that, although they look intelligent, they are deficient in physique. I am only an average sized man, but if I go among a body of seamen I am generally about a head taller than most of them. I do not think that was the case when I first went to sea. I cannot myself suggest a remedy for it. Of course I am speaking of man-of-war seamen only, and I think that is a question that requires being examined into. Now here is a point that I wish strongly to remark upon. It is a proposal in one of the essays for the abolition of the special class of seaman gunner. That is advocated in what appears to me to be rather a dogmatical style. The writer says: "The principle upon which our gunnery training is based, viz., voluntary engagement, is, in my opinion, not only absurd, but prejudicial to the very spirit of discipline, as it virtually makes every man a judge, whether in a most important part of his duties he shall or shall not know his work." I can see nothing whatever absurd in a man volunteering for a special course of training with a view of ultimately getting 4*d.* a day. Then the essayist says that he comes forward for training for a seaman gunner with a view of having a long spell in harbour. I think, if we come to examine into that, we shall find the custom of the Service is that after three years at sea a man has a year in a harbour ship, if possible. I think you will find that the men who go in for training as seamen gunners, during their course of service get but very little more time, if any, in harbour ships than any other class of seamen. Commander Grenfell says, again, that a ship is not the place for such a training. If a ship is not, what is the place for training men to fight ship guns? He has pointed out the necessity of having good captains of guns, as I understand, in lieu of a special class of seamen gunners. But it is a fact that the object of the training of our seamen gunners is to make good captains of guns. He must be a seaman before joining a gunnery ship. Of necessity he must be a good shot—for if he is not, he ought not to be allowed to pass for the rating of seaman gunner; but he must be something else, he must be a quick shot, a man of command, knowing every part of his drill thoroughly: in action he will not have anybody to stand over him to correct him, to see that the compressors are set up right, that the gun is properly loaded and pointed; and so he requires to be a man of special training. If we look at the actual number of guns in the Navy, I think we shall find that the present seamen gunners are not more than sufficient to provide a captain for each gun, certainly not more than are

required, if we are to have a few to spare. Again, the first thing to recognize, and it is a highly important point, is that it is neither possible nor desirable to make every seaman a captain of a gun and an instructor. If this is given as a reason for the abolition of seamen gunners, I differ from it entirely; I agree it is not possible to make all seamen gunners, but I say it is desirable to make a seaman gunner of all that are capable of qualifying, and also that he should be, to a certain extent, what he is supposed to be, an instructor. Our seamen gunners are supposed to be instructors. Immediately war breaks out, there will be no more training of seamen gunners: our Navy would be increased somehow; we should buy ships, we should arm ships, we should get ships, and we should want a large number of gunners. My idea of a man that wears a seaman gunner's badge on his arm is that he can be sent into an armed merchant ship, and there drill a few men, for a gun's crew perhaps, without an Officer over him. One proposal is to take away the extra pay from these men and give it to captains of guns. It appears to me that it is the same thing, and it is perhaps immaterial what name is given to him. I am strongly of the view that we should do more in the way of what we have done lately, viz., having numerous tenders to the gunnery ships and send them to sea for target practice. It is quite a necessity. I hope it will never be in my time that the principle of training in gunnery ships and their tenders, and having a special class of seamen gunners for the Navy, will be abolished. I think every Captain knows that the nucleus of his ship's company are those very seamen gunners, and I do not see any reason for abolishing them. One instance is quoted as against the training in gunnery ships, viz.: "I have known men as much as fifteen or eighteen months in a gunnery ship, out of which time they have only been fifty-seven days actually at manual drill." All I can say is, that it must have been an exceptional case, or else it was the fault of those who had the arrangement of the training classes; it need not and should not have been so. I should like to say, with regard to Volunteer Corps in connection with torpedoes, that I concur with General Schomberg: we must be very careful how we mix up volunteers with those delicate and dangerous instruments of war, torpedoes. Our naval volunteer corps should, under any circumstances, deal only with the locomotive torpedoes. They do not require any knowledge of submarine mines. The question of submarine mining with naval Officers is not a primary one: it is only for the protection of their own ships under certain circumstances, and the destruction of the enemy's mines, that a knowledge of submarine mining is required of naval Officers. Submarine mines must always be placed under the protection of artillery, and the Commanders of the forts protecting mines should have the direction of the submarine mining operations. I think it is a military question, and not a naval one. I can only add my mite of thanks to the Officers whose essays have been published, and I think we have derived very great benefit from them.[1]

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[1] Time did not admit of my making further remarks on this subject during the discussion, but I wish to record my decided dissent from some other views expressed in Commander Grenfell's essay, especially in the paragraph respecting the re-qualifying of seamen gunners, which begins by saying, "The present system of re-qualifying seamen gunners is ridiculous in principle, and exceedingly costly and inconvenient as put in practice." I fail to discover the slightest particle of ridicule connected with the subject. As a matter of fact, when a seaman gunner has qualified, it is a chance to what description of ship he may be drafted. During the commission of that ship, he sees no other type of guns than those forming the armament of that ship. Possibly the ship is a corvette or small craft, in which there is nothing larger than a 4½-ton gun. On paying off, he returns to a gunnery ship for a longer or shorter period, according to his absence, and the requirements of the Service, and is in due time drafted to another ship—probably this time a turret ship, or a ship with many broadside guns, of which he is to take the position of captain and firer. It is possible to put any question in a ridiculous light, but I maintain, with some knowledge of the subject, that if the spirit and tenor of the instructions are loyally and carefully carried out, especially by those entrusted with the detail, the present system is most valuable. Some system,

Captain J. C. R. Colomb: Having to compress remarks, on a very wide subject, into ten minutes, it is not easy to be clear. I would, therefore, beg to refer those who cannot follow me to my former writings, most of which are in the library upstairs.[1] It is necessary for me to say this in consequence of a former ten minutes' remarks having been misunderstood, and a view was attached to me which is not mine. This renders it desirable for me to make a personal explanation which will not, I hope, be deducted from the orthodox ten minutes now. Commander Grenfell, in his essay, p. 324, says: "Captain Colomb, R.M.A., seems to contemplate the employment of at least 400,000 tons of merchant steamers, carrying 1,200 guns, and needing 12,000 trained men." Then, on p. 327: "If anything approaching to Captain Colomb's view of the employment of armed merchant steamers is to be entertained—if, in short, we are to give free play to our imagination." Now it is that statement I wish to correct. I never have contemplated "the *employment*" of any considerable number of merchant shipping. On the contrary, I have most clearly and distinctly pointed out, as my opinion, that the Admiralty cannot employ, or take away from the carrying power of the country, any considerable portion of the Mercantile Marine fleet to supplement the war fleet.[2] But I have said that merchant steam vessels will, while carrying on their avocations, require means of self-defence in war. I have said we must be prepared to give them guns and torpedoes, and that these weapons will require a force of trained men. "My rule of thumb calculation," as I termed it in the passage to which Commander Grenfell refers, that you must be prepared to arm and complete, with a nucleus of trained men, 400,000 tons of steam shipping is not, as my old friend says, "giving free play to the imagination." For 400,000 tons was, at the time I spoke, and is now still less than *one-tenth* of the British mercantile steam shipping.[3] To propose to give means of defence to one in every ten is not, I say, "giving free play to the imagination," but is a moderate business-like estimate, especially considering it was made off-hand in the hurry of a ten minutes' speech. Now for the subject in hand. I congratulate the Institution, and the Service generally, upon the results attained in this number of the Journal. I rejoice to see, among others honourably mentioned, one so young in age, and so subordinate in rank, as Sub-Lieutenant Tupper. But I do regret to have to say, I see that in these essays provincial prejudice and narrowness of view too much prevail. In all except one, the writers refuse to look beyond the United Kingdom for naval resources. With one exception, they ignore those to be found under the British flag in the Colonies. The youngest writer is the bright exception; he does refer to them in a short paragraph alluding to the fishermen of Canada, but he underrates the number, and wholly passes by the Mercantile Marine of Canada. Captain Lindesay Brine, with settled and distinct purpose, while (p. 206) lamenting over the paucity of British seamen possibly available under the British flag, deliberately excludes from any consideration the Mercantile Marine of the rest of the Empire. Is Captain Lindesay Brine aware that Canada alone is about the fourth great carrying Power of the world? Is he also aware that a competent authority in the merchant service in Australia has pointed out that there is a possible 2,000 Naval Reserve men—British subjects capable of being organized—in our Australasian Colonies? I ask him to give in his reply, or at some future time, a distinct public reason why he so deliberately ignores his fellow-subjects and fellow-seamen of Canada and Australasia. Some eighty years ago, Pitt, backed by Parliament, prompted by naval instinct, turned public attention to Canada for the

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fixed and publicly avowed purpose of planting and nurturing up future strength for the Royal Navy of England. Now, when nearly a century has rolled away, and the seed then sown has blossomed, fruited, and is ready for the naval sickle, British statesmen and the naval essayist of to-day trample upon the crop; indeed, one of the essayists rides rough-shod over the crop in his haste to find strength for the Royal Navy of England in the gutters of home poor-houses. Turning to details, these are all comprised under the term "naval organization." Your naval organization to-day is—as pointed out by Captain Brine—based on the report of the Manning Commission of 1859, which report, in its turn, was based upon the evidence it received. But, as I pointed out in a series of four lectures here, in 1869 and 1871, principles of organization are dependent upon, and must be adapted by, the necessities forced upon you by distribution. Now, when the Manning Commission of 1859 sat, the *personnel* of the Navy was distributed mostly in what were practically sailing ships. Our flag-ships in foreign stations were, I think—with one exception only—sailing ships, pure and simple: the "Ganges" and "Boscawen," for example. But were that Commission to sit now, it could not make the same report, because the evidence laid before it would be wholly different, and therefore you could not have the same organization. It is not to be supposed that Admiral Milne would now give evidence that, "in a great war you will never be able to keep up that supply of coal upon your foreign stations, necessary to meet all demands of your fleet;" nor would Admiral Sullivan tell the Commissioners that "these large ships cannot be worked by steam;" nor Admiral Elliot say that "ships always cruize under sail." Nor would the Commission innocently ask, "Is not a ship, according to modern warfare, manœuvred by steam to a large extent?" Odd as all this sounds now, I beg you to recollect that your naval organization of to-day is based on that evidence. We are forced now to distribute a large and increasing portion of the *personnel* in mastless vessels, but we continue to apply a naval organization, adapted wholly and solely to sailing ships. Admiral Sherard Osborn, who commanded the first mastless vessel—"Royal Sovereign"—on his experimental cruize was prepared, from experience gained, to cruize her and fight her manned—not officered, mark you—practically by marine artillery; but he would not, I fancy, have cared to be caught in a puff of wind outside Spithead in a sailing ship with a complement so constituted. Years after this experiment, there was a naval review at Spithead—a spectacle for the Shah and Europe, and the extraordinary sight was exhibited then of mastless reserve vessels, wholly manned by seamen, and heavily sparred reserve ships, manned by marine artillery and infantry. If, on the following day, at the military review at Windsor, the infantry had been put on horseback and the cavalry on foot, you could not have had a better illustration of false organizations resulting from a disregard of the necessities of distribution. Were you now to treat the whole Army as one force, and jumble Officers and men all together in a bag, then serve out indiscriminately to the various arms—horse, foot, and artillery—and change them at random every three or four years, you would have a military parallel of the naval organization of to-day such as we are trusting to, and such as the Prize Essay seems to prefer. Captain Brine complains, and it is a common complaint, that the young seamen are insufficiently trained; that they crowd our harbour ships and naval barracks, and that they cannot, at present, be sufficiently trained. Why? Because there is no room for them in sea-going sparred ships. This is a very serious matter, considering one-quarter of your *bonâ fide* seamen are under nineteen, and one-half not over twenty-one years of age. As I ventured to say fifteen years ago, so long as you will keep marine forces in sea-going sparred ships for years at a time, so long will you have no room to train in sea-going sparred ships your young seamen, and your young seamen must continue to learn their seamanship from the deck of "Inflexibles" or "Devastations," and to develop "self-reliance" and "readiness of resource" moored head and stern in mastless harbour hulks. Seven years' experience as Adjutant of Marine Artillery taught me that the longer a gunner of marine artillery was kept in a sea-going masted vessel, beyond a certain brief period, the more difficult, if not impossible, it was to bring him back to his original condition as a well-trained sea gunner, and a thoroughly well-disciplined man. By disregarding the universal law that principles

of organization are subservient to the necessities of distribution, we are, I maintain, jeopardizing the training of our seamen and spoiling the marines, as at present constituted and misapplied. One word as to how this disregard of organization affects the all-important element of cost—which, by the way, is omitted from the programme of points for discussion, though it is the most important of all. It is the want of principles, of which I venture to speak, that causes us—as I pointed out years ago—to have to spend so large a sum as over 150,000*l.* a-year on a special class of non-combatant Officer—the Naval Paymaster branch. The same cause produces what I call the fraud and swindle on the public purse of over 150,000*l.* a-year on marine artillery and infantry Officers. Part of this goes in providing for and training these Officers to do nothing on board ship, even while naval Officers are landed to fight as soldiers on shore; the rest is spent in keeping their artillery and infantry Officers on shore in one long hopeless grind of drill and study, so as to be ready to scientifically do nothing again when they re-embark. All this involves a further public expenditure of some 400,000*l.* a-year, either to retire trained combatant naval Officers, in the flower of their age and usefulness, or to keep them dozing the weary hours away in club arm-chairs, because, forsooth! it is said there is no room for them on board ship, no room for them in the active duties of the Naval Service; though the duties of Naval Paymaster, of marine artillery and infantry Officers, ashore and afloat, can be done by Officers who have been, or who still are combatant naval Officers, were the Navy organized, and the necessary training and opportunities given. Those opportunities, and those means, as I have during many years urged, require barracks and a properly organized system of discipline and training; and when the Navy gets such necessary means for developing a real system, it will, as I have frequently pointed out, be an improved marine artillery and combatant force of artificer naval infantry on a great scale—with a "place for every man and every man in his place." Finally, in opposition to Lieutenant Campbell's opinion, that the Navy is "the most perfect organization that exists" (p. 259), I beg to say that having served sixteen years in the marine artillery—seven as Adjutant; having served as Gunnery Lieutenant of a frigate, also as Adjutant of artillery militia—further with the Army and with the Volunteers—in my humble opinion, the Navy at present is the most disjointed and unorganized service under the Crown. That is my opinion, taking, of course, the Navy as a whole; and nothing to my mind reflects more credit on the character and ability of our naval Officers than that their individual efforts should be able to produce such wonderful results—in peace. Whether in a great war spasmodic efforts of individuals can supply the place of complete and perfect organization, capable of rapid expansion, is a question war alone can answer; and, if England allows the Navy to continue as it is, without means of organization or easy expansion, I, for one, trust I may not live to see war's answer to England.

Captain P. H. Colomb, R.N.: I think it is a matter for congratulation to the Service (I say it with a little fellow-feeling) that the senior Officers should have come so well to the front generally in these essays. It is known throughout the Service that the judges have no notion whose work they are judging, and I think it speaks very well for the Service, and must have a very good effect on the rising generation, to see that the older men are taking their proper place in this question. In looking through the essays I have been much struck with the way in which they supplement one another. It is really as if the judges had selected portions of the work done, so as to make a complete work of the group. You have in the Prize Essay a very comprehensive and excellent introduction to the whole subject. I do not know that I have ever seen so comprehensive an introduction to so large a subject, put so clearly, and in so few words. In Lieutenant Campbell's you have a close and first-rate examination of the details of the question. In Commander Grenfell's you have a clear criticism of the whole thing without so many proposals. In Mr. Tupper's you have a short but still very good summary of the question. And lastly comes Mr. Laughton's paper with that very necessary examination of his own subject—the examination and judgment of a highly qualified expert on perhaps the most important part of the whole. The essayists are dealing with the raising, training, utilization of Officers and men, and I suppose the final disposal of the sponges

after they are squeezed dry. There are some general considerations we should keep in our minds as we proceed. We have to contend at the present epoch with a most astonishing rage. We have a rage for youth, which did not exist among our ancestors, and which I cannot conceive of as existing very much longer. We all have it. We may exclaim against it as much as we like, but we do think we must get the young people as young as possible, and get rid of them as soon as we can, because grey heads or bald heads do not form part of the scheme of economy generally. What we have to do in the Navy is really to "welcome the coming, speed the parting guest." The parting guest is the seamanship of the past, that which confined itself to the management of a ship under sail alone. The coming guest is steam, mechanism, and forces of all kinds other than the winds. Now, instead of frankly going out, shaking hands, and bidding goodbye to the parting guest, and wishing him well, and going down the steps to meet the new one and bring him in, we are holding on to the coat-tails of the old one, and trying to shake hands with the coming guest with the left hand, or perhaps with only one finger. I think that is one of the difficulties we are in at present. As Captain Brine puts it: "The history of the training of our young Officers has been for the last fifty years a series of endeavours to fit in the new requirements of the Service with the traditions of the past." But that is not confined to the Officers: it is true of every part of the question from the beginning to the end. If we could get on as we did eighty or a hundred years ago we should not be discussing the question now. The whole difficulty is to fit the requirements of the present with the traditions of the past; or to put it otherwise, your business is how to throw away the refuse of the past, while holding on steadily to all the grains of gold to be found in it, of which there are so many. Then comes the question which, as my brother has very well pointed out, has been curiously omitted from the whole of the essays—the biggest question of all—the money. We are suffering under another condition of feeling similar to the rage for youth, and quite as wrongly placed. We think in England that the expense of the Navy is something terrific, that it is overwhelming, and that unless we can get the estimates down every year we shall never get on,—that we are, in fact, going to pieces. The fact of the matter is, it is nothing of the kind. We are spending on our Navy much less than we ought, taking quite a business-like look at it. If the taxpayers could have the figures before them, however much they might object to general taxation, they would not, I think, object to special taxation for the Navy. Here are some figures I have got out. In 1828 the people paid 5*s.* 6*d.* per head for the Navy; in 1848, 5*s.* 11*d.*; in 1868, 7*s.* 1*d.* In 1878 there was a fall to 6*s.* 6*d.*, and in 1881 still lower to 6*s.* 2*d.*; so that taking the cost per head we are gradually going down the hill; instead of increasing the cost, we are decreasing it. Then take another comparison, the percentage of the naval estimates to revenue. In 1828, 10·8 per cent. went to the Navy; in 1848 it was 13·7 per cent.; in 1868 it was 15 per cent.; in 1878 it was 13·7 per cent.; and 13·1 per cent. in 1881. So that again on that comparison, instead of our spending more on the Navy, it is at the present moment getting less costly. Lastly, take the best comparison of all, which has been brought forward by my brother's speech to-day to a certain extent. Take it as a percentage on our foreign commerce. It was 6 per cent. in 1828; 3·3 per cent. in 1848; 2·6 per cent. in 1868; 1·8 per cent. in 1878; and 1·6 per cent. in 1881. Now, is 1½ per cent. a very large sum? I call it very small compared with the foreign commerce which our Navy has to protect. I think the contrary idea is a mere cobweb, which ought to be brushed away, and which statesmen in the House of Commons ought to be able to brush away. We are not paying as much as we ought to be paying, taking the business-like view of it. The rage for youth affects us in many ways. At present it is preventing our having as large a supply of young Officers in hand as we used to have. I am not going to enter into the question whether that ought to be so or not, because it is hardly the province of this discussion, but the difficulty of disposing of the young men undoubtedly prevents us from entering them. Then it goes on and dismisses to the lumber-room of decayed furniture very excellent pieces that have still a good deal of work in them; and of course when you buy new furniture to take the place of the other, it leads to some little expense. But in spite of all these difficulties, I do not think that anybody reading the essays can say, after all, that things are so very bad, provided we

do not let them get worse, and that we open our eyes wide and take care to proceed only in the directions which will make them better. Even Mr. Laughton cannot help quoting Professor Soley, that somehow or another, perhaps in spite of the muddle we are presumably making of it, we do produce a great number of very excellent naval Officers, such a class of Officers as the whole world looks up to still. Of course they say we are not scientific—not what we ought to be; but somehow or other, the English Officer gets a character abroad which is very satisfactory. I am certain we are all agreed that the rage for youth is quite fallacious. It does not rest on any proper foundation. You cannot go back to past years and say for one moment that the young men were better than the old men. The fact is, there were things that the young men could do and the old men could not do; but there were things that the old men could do and the young men could not do. You require the judgment and coolness which an old man somehow gets hold of, and a young man has not. At the same time, to supplement that, you want the activity and quick blood of the young man. You have got now, I am afraid, not only in the Service, but in the country, a premium on precocity. I have always understood that the most slow-growing trees are the best in the end. The child is not altogether the father of the man. Sometimes the child is very deceptive as to what the man will be; and the precocious boy is apt, like Mr. Toots, to blow too early in his career, and then to blow no more. I am afraid there is a little of that tendency going on now. Then it leads us to place artificial restrictions on the progress of our Officers; and it strikes me as a very remarkable fact that the great leader of our Service—as we may call him—(Sir Alexander Milne) should go away from the Service, carrying away the highest honours, and yet no single soul in the Service should be able to follow in his footsteps, being prevented from doing so by the artificial restrictions which have been created. I always refer to Sir Alexander Milne's as a career of remarkable usefulness to the Service, which can, under present regulations, never again be carried out. As to the entry of the Officers, I incline to the later entry; and I am somewhat afraid of the condition of things which arises from passing the boys away from the "Britannia" where they have been well taught, into a ship where they may or may not be well taught, and where, according to the service that the ship is on, and the class of the naval instructor, their chances are good or bad. Those who have had a bad or inferior naval instructor come very much handicapped to the college as compared with those who have had a good instructor. I think that is one of the difficulties, though I am not prepared to say how it should be altered. Then we have been trying to settle matters in this way: we have taken away the boys from the small ships, where they would have been put in positions of responsibility, and have learnt that readiness of resource which has been described as the root of seamanship, and they are put now only into larger ships where they learn seamanship by rule. But they do not learn that self-reliance and self-resource which are only to be got in small vesse'ls where a young man begins as an Officer of the watch early in his career. Then you come to the examination at Greenwich, which I would rather see, I think, act indirectly than directly. I am afraid that sometimes Officers fail at Greenwich and get thrown back in the Service who have very excellent stuff in them; and I would rather see that a good examination at Greenwich should be a distinction to a man to help him hereafter than make his career in the Service at all dependent on the examination he passes through. But I think the great difficulty just now in the training of the Officers is that young Officers, especially Sub-Lieutenants, do not see their way to promotion—that they are afraid that the prospect is not sufficient for them. The block in the lists at the present moment, which we hope may be cleared by-and-by, I fear has a great effect upon the young Sub-Lieutenants, curbing their zeal and keeping them back. Were some better prospect before them it would help them very much. Turn now for a moment or two to the men. We have complaints to deal with of the youth of the ships' companies. It varies. In a ship that was commissioned the other day, I hardly saw one young man among them who was not a fine grown man; but in another ship the number of youths was exceedingly marked, and it did not leave one comfortable to think what would be the result if we had to go into action pitted against a ship's company consisting of much older and steadier men. A very simple plan to increase the age would be to make the first entry

twelve instead of ten years; and when a man had served his twelve years, he would say, "At any rate I have got over the best half of it, I am not going to throw away twelve years for the sake of eight, and I will ship again for eight years;" whereas if you cut him in the middle, he will say, "I have done ten, I will not do another ten;" and he is apt to take the chance and quit the Service in that way. To come to the Naval Reserve itself, I was very glad to read the warm words which Captain Brine had penned in regard to the Mercantile Marine and the Royal Naval Reserve. In times when we are mostly critics and fond of turning the cold shoulder to one another, rather forgetting that we are Englishmen in our differences, I think that some warm words addressed from the Navy to the Mercantile Marine and Naval Reserve are of the greatest value. I regard the Naval Reserve, as now constituted, as eminently successful. We are told it numbers 12,000 men. We are told that is a small number; but 12,000 seamen means the crews of forty first-class ships; and as Sir Frederick Nicolson pointed out or suggested, as a matter of fact we have not got anything like forty first-class ships in reserve. At the present moment, the seamen proper in a ship only number three-sevenths of her company; the rest are made up of marines, artificers, stokers, Officers, engineers, and so on. The value of the Naval Reserve is this, that it is independent of the Navy. If peaceable times come, you may be reducing the Navy and cease to have any overflow, but your 12,000 men you can keep steady under your lee: and they are always ready there, even if the Navy be reduced. I think the great want just at the present moment is a larger reserve of disciplined stokers and artificers. The propulsion of our ships now is a most important part of the business, and I should like to see established a disciplined force of stokers and artificers; and I think that in the discussions raised by my brother so many years ago on how to deal with the marines, it was suggested—I forget by whom, or whether it was by himself—that it might be exceedingly useful if you drew them more towards the Navy than they are; if you embodied in them your disciplined stokers and artificers, and made them more like the Royal Engineers, so that you always had this force, not only of skilled men, but of disciplined men, at your command. Then I think you would be doing a good service, and one that would pay and answer well. When I speak about the necessity for disciplined stokers and artisans, and when I suggest the possibility that we may not be quite as full of the junior Officers as we could wish, I have in my mind the very peculiar character of a modern man-of-war. Everybody is fighting in a particular hole of his own—a little group here, a little group there, and a little group further on, which are not at all in connection with one another. They hear the noise; they hear the shells burst, but they must imagine what goes on; and I dread lest we may have a panic in one little hole which will spread to another, and so we may have panics spread all over the ship unless we have disciplined men down below and they are supplemented by steady and cool young Officers. I think by employing deferred pensioners you might, without much cost, increase the age of your men. My own impression is that a great many married men would stay on by the offer of deferred pensions. I do not think, as a rule, when a man comes to take his pension he is in a hurry to go; and if you increase his pay and defer his pension, giving him some more when he does go, you will probably get him. I finish off by what I said in the middle of my remarks, the money. We want another million—that is the English of the thing—and I am quite sure, on business-like principles we ought to spend it.

Captain CURTIS, after reading the curriculum of study at the Royal Mathematical School, Christ's Hospital,[1] said: I think Admiral Luard wanted to know what boys can do in that way, and I say that really all the boys in the Royal Mathematical School pass an examination in navigation, the paper being that set to a Sub-Lieutenant in the Royal Navy, and this they do before they are sixteen years of age! I suggest that the method of entering cadets should be from public school-boys from fifteen-and-a-half to sixteen years of age, and preference should be given to sons of naval Officers, provided they could obtain a certain

[1] This school was founded by Charles II, for educating and providing young Officers for the Navy.

certificate. My father had the greatest difficulty in getting me into the Navy, although he was ten years in the East Indies, at one stretch, *and had Meritorious Service.* I object to the "Britannia," inasmuch as the boys are all cast in one mould, and are not likely to have the variety of resource of boys from different schools, and I think if they went from different Institutions, it would be much better—boys would be stronger. It is not always those who are the most clever in mathematics, and the theory of their profession, who turn out the best practical Officers in an emergency; "*coolness is a great quality* in difficulties." All of us have heard of John Clarke, Esq., the antiquary of Edin . . . . . who wrote on Naval Tactics in 1782; and it is very well known, that after that, the British Fleet was very much more successful when his tactics were applied. With regard to the method of recruiting, if you refer back to an old paper by Captain Toynbee[1] on the social position of our seamen, you will find that the most efficient lads or novices to enter the Mercantile Marine were the Orkney lads at sixteen years of age. I suppose we may compare them to turtle: they live half on the water and half on shore. One-third of our recruited men should be recruited from fishermen and lads of sixteen. I have had a good deal of experience with boys and Naval Reserve men. The fishermen are as good a class as you can get, and should be induced to join when young—the lads could learn cutlass and rifle drill—but all that entered as fishermen were not fishermen. On one occasion I had to furl sails in a hurry, and twelve or fourteen of them did not know how to go aloft, and when I came to examine them they were not fishermen at all. I think that the inferior physique of many of the boys arises from the fact that they have not been well fed previously to their entering the Navy; and they are too many hours between decks. When you enter a boy at sixteen or seventeen you get hold of a strong lad, for the weakly boys die, or give up going to sea. As Admiral Boys said about our seamen, if you go to Yarmouth and see the kind of fishermen they are, one of them would make two of our men. I think it is a great mistake to enter lads from the midland counties for sea service. They should be taken from people accustomed to sea. We all recollect "Jacob Faithful," the barge lad, who took a header off the fore-yard. I think the Coast Guard should be increased considerably; when I was in command of a division, the clergyman and gentry informed me that the Coast Guard were much respected, and did a great good by their example, mode of life, &c. I think there is plenty of room for the employment of more Officers on the Coast Guard. I agree with Captain J. C. Colomb. In North-west British Columbia there are 8,000 miles of sea coast including the islands. There are Russians to the north close upon us at Alaska, and the Americans on the other side south, and I think we should have a naval depôt there, and encourage the fishermen to colonize that part. The wealth of the fisheries in North-west British Columbia is beyond description, it is hardly tapped as yet.

Rear-Admiral J. C. WILSON: I shall take the points *seriatim*, as they have been submitted. First, the age and method of entering naval cadets. This has been very well discussed by Admiral Luard, and I may say that something like the views expressed by him to-day are very general in the Navy. I think the time has arrived when youngsters should join the Navy later, say between sixteen and seventeen, direct from public schools, possibly going through a short preparatory training in a sea-going ship, before being sent to the fleet as midshipmen. I do not think that the purely technical education they get in the "Britannia" is so necessary as some people are inclined to think; I agree with what General Schomberg said on this point: "We do not want a body of naval professors as Officers;" if you bring in youngsters by open competition at a certain age with a good sound education, those who have any particular leaning towards any particular subject will naturally take it up afterwards, and from those will

[1] Lecture, July 16th, 1866, vol. xi, chap. 2, Commander Dawson, R.N., stated the decrease of apprentices from 1858 to 1863 was 4,000; increase of tonnage 1,000,000; increase of seamen 20,000; four foreign seamen added daily, and two English seamen subtracted; must have recourse to some form of apprenticeship to keep up the supply. "The State cannot look on with indifference" at this state of things. The Mercantile Marine will require its own reserve if we are to carry on our trade.

gradually be produced the round men for the round holes: each person will come on, and take up his specialty, and being thoroughly well grounded before he goes to sea, he will gradually take up such course of study as will best suit his abilities and desires. I will next touch on the question of the promotion of Sub-Lieutenants. With regard to them, so far as I have been able to judge, a little too much weight has been attached to the examination at college, and too little to the reports made by the Officers under whom these Officers serve at sea. I think that a combination of the two would be the correct thing. For I know that a man may pass a very good examination at college and still be a very poor hand on board ship. Though it is advisable to encourage them to pass as high an examination as possible at college, yet I think that the reports made by the Officers under whom they serve at sea should be the reports on which promotion should mainly depend. I have been shipmate lately with some of the best Officers I ever met at sea, who passed third-class examinations at college: such were not only good executive Officers, but possessed great ability and special acquirements. I have in my mind's eye now a Lieutenant quite a mechanical genius, a first-rate surveyor and navigator, and a good Officer all round, and yet he took a third-class. I therefore consider we should think more of reports and less of the class at college. As to the permanent appointments of Captains, I dismiss that as not worthy of consideration. Of course Captains must be changed from time to time. With regard to the method of recruiting at present, it has very great advantages, and very great disadvantages. If you recruit boys when they are young you get them before they have attempted any calling, but they are more expensive than when taken later. When I was Inspecting Captain of training ships I watched very carefully the entry of boys, and I found out that the percentage of deserters[1] and ne'er-do-weels rose in proportion to the ages at which they entered. Among the boys of fourteen-and-a-half coming directly from school,[2] we had hardly any failures, but of the boys who were sixteen-and-a-half a very large percentage turned out badly. While upon that particular point, I will touch upon another which is cousin to it, and which was referred to by Captain Brine, and that is the suggestion of entering novices. He founds his recommendation upon what he saw in the French service, but the difference between the French and ourselves is, that the French take them by a conscription, and they are drafted, good, bad, and indifferent, to the ships, so you get the cream and the milk together. In our case we should be entering lads who have been failures in other callings. If you take lads of eighteen or nineteen, and try to make seamen of them, I feel confident that a large percentage will prove perfectly useless, because they have probably failed in other callings before they attempted the Navy. Captain Brine also speaks of the inferiority of the physique of our men. The physique of our boys on joining the training service is very good. It is true they are crowded, but they are well fed, and develop satisfactorily whilst there; but the men in the fleet are indifferently fed, especially when at sea. The very able report written by Dr. Read, Fleet Surgeon, now at Haslar Hospital, shows the whole thing. Taking such data as he had at his command, he found, that with a young crew on a long voyage, the men spent individually, on an average, sevenpence a day in the dry canteen on food to keep them going. This shows that the men are insufficiently fed. I believe that is the root and reason why our men do not develop. There is an argument that our men leave their provisions behind, and that therefore they have too much. They have too much hard biscuit and salt food; but if their food were better arranged—and there is no reason why it should not be so now-a-days—I have no hesitation in saying, and I believe all medical men will agree, that our men would develop a far finer physique than at present. With regard to extreme youth, that is a point on which I have spoken before, and I look upon it as the sore of our Service, to think that one-half of our 18,000 seamen—what are called in the House of Commons "pure blue-jackets"—that is 9,000, are under twenty-one years of age: it is really a serious matter. Out of the

[1] The desertions were 70 per cent. over seventeen years of age, and 16 per cent. under sixteen years of age.

[2] These, formerly called the school-boy class, are not now entered.

other 9,000 you have to take 3,600 petty officers, and I ask, what able seamen have you left? I have held in this theatre that the true estimate of our seaman class is the number of able seamen. An ordinary seaman is a seaman in embryo—an apprentice. Taking my view we have not 10,000 British man-of-war's men in the fleet. I have seen Germans, French, Italians, all nations, within the last two years afloat, and I have no hesitation in saying, that there is not one of them that would not outweigh our ships' companies, man for man, by several pounds, to say nothing of their ages. Now, as to the advisability of entering a certain proportion of older boys or men, and of men from the second-class reserve, I have already touched upon this subject, but I may add that entering *shore* men older would only bring us more ne'er-do-weels into the Navy. The weak point of our Naval Reserve is, that they are undisciplined men. They have not passed through the Navy, and in case of a war—which if we have one will be short, sharp, and decisive—we shall want the crews not at their worst, but at their best; and I think it a very great drawback to our Naval Reserve that they have not passed through our Service. One essayist, who, I believe, does not place quite the same importance on this as I do—still he evidently places weight on it, for he refers indirectly to it in a dozen different places in his essay, which I may here say is a most admirable one, and the best that has ever been written on this subject. For instance, referring to the *Infanterie de Marine*, he says that what takes away from their value as a reserve to the French Navy *is the fact that they have not been trained or drilled on board ship*, and are *not acquainted with naval discipline*. You will find in several other places in his essay, that he speaks in the same way of kindred subjects, where he draws attention to their want of naval discipline. But he speaks particularly of the French reserve, that they have naval discipline. Now, our men are without naval discipline. People say merchant seamen will not join the Service—that is because they are not wanted, but I think if we could make the door to the Naval Reserve through the Navy, it would be better to have 6,000 men, having passed through the Navy, than double the number that had never served in it. Captain J. Colomb very properly referred to the Colonies, and said that we have Naval Reserves in them. At Sydney we have 350 men, who would bear comparison with the Naval Reserve in England, and many of the men are superior, inasmuch as they have served in our own Service. At Melbourne we have between 400 and 500 in the reserve, and standing Navy, and for physique we have no body of men in ours equal to them. They are magnificent men, taking them all round. These corps are worthy of being considered in reference to our Naval Reserves. I could go on upon that question, but as time is pressing I will not do so. With regard to the abolition of seamen gunners, which Admiral Boys spoke about, I think he mistook—or at any rate, if he did not, I have done so—the intentions of the essayist. An idea very prevalent in the Navy is that the whole of the permanent Navy should be composed of seamen gunners; not that we should do away with those we have, but bring the others up to their standard: by so doing, we should do away with one of the greatest evils in the Navy. There are some 1,200 boys rated men every year; these youngsters are put, together with all your second-class men and inferior petty officers, into the guard-ships, whilst all the best men are taken for the gunnery ships. Mix them all up together—make seamen gunners of them all! If a man is not fit to be a seaman gunner, he is not fit for the permanent Navy, considering that we have only 18,000 seaman of all classes and rates. As to barracks, I look upon them as absolutely essential to the good organization and proper training of our men. I think there is a great deal in what Captain Colomb said: we want more organization and more unity of purpose throughout the Navy; we should not be pecking at it at every corner, every one having his own hobbies. With regard to non-combatants, Captain Colomb spoke about them, and pointed out the enormous number belonging to a ship. The idea of bringing marines in as artificers is not new. I think General Schomberg was one of the originators of it, and Major Moody is another, I believe. Artificer companies, attached to the marines, would enable you to do away with a very considerable section of the class which is a weakness in a ship-of-war. In a ship with only three-sevenths seamen, and about one-seventh marines, the remainder must be non-combatants! Where are you, then, if you man and arm your boats? You have no fighting men left on board your ship! Every man on board a man-of-

war should be a trained fighting man, or he has no business there. Then with regard to merchant ships in times of war, the assistance we derive in *personnel* from them is represented by the Naval Reserve. I believe myself we should arm merchant ships, and I also go with Captain Colomb, in thinking that in place of having men-of-war to guard convoys, the faster merchant ships should be armed. With regard to the increase of Coast Guards, I quite agree with the essayist, that that is the only reliable reserve we have except the marines and pensioners. I would say, let the best men from the Naval Reserve, if they wish to join the Coast Guard, serve two years in the Navy to qualify themselves, and if they are reported fit, let them go to the Coast Guard. Then, with regard to the enrolment of fishermen, I do not know whether you will get them. Volunteer torpedo corps are a delusion and a snare. I know of an Officer with a boat's crew who were blown up[1] through telegraph electricians playing with torpedoes. You want special men for special purposes, and I think when anything is afloat it must be placed in the hands of seamen. A man is not a seaman merely because he reefs a sail or rolls a top-gallant sail. A seaman is a seaman if he is fitted to perform the duty of the ship he sails in, and to be really a good man he must vary with the times, and the machine he has to work in.

Vice-Admiral PHILLIMORE: I have studied these essays very closely, and I think there has been a little misapprehension about the intention of the essayist as to the Canadian fishermen. I did not read in that essay the slightest slight intended, nor do I believe there was any slight intended, either towards our Colonies, or Canada in particular. The argument of the essayist, which I think a very able one, is as to what we should require ourselves in case of war, in the first instance; and naturally enough the Colonial and Canadian seamen must be left out of that calculation at the beginning, because a war with us would involve a war with them, and they might be called upon to defend their own shores first, and therefore they were left out in his calculation of the reserves we could put our hand upon immediately. But there is no doubt they would be available after a time. I also think, as Admiral Wilson has put it, that the question of the seamen gunners is misunderstood. The essayist wished all the seamen to attain such a knowledge of gunnery that it was not necessary to specify who were taught gunnery and who were not. All seamen would be supposed to be seamen gunners, and those of a very high class might have a different rating, but it would simplify the nomenclature, and that was, I believe, all the essayist meant.

Mr. PFOUNDES: I shall not presume to speak on the higher technical points. There are one or two special points that have not been dealt with by the essayists, and certainly not alluded to in the discussion. With regard to the first group of items on the list of "Proposed Points for Discussion" I will not venture to say anything now; but there are several matters connected with the second and third groups that are incorporated in the sketch of a paper I submitted to the Council before the Prize Essays were issued. For certain reasons it was not advisable that I should compete, and I thought it better to offer a separate paper, because my subject principally treated of utilizing the merchant seamen for manning our ships, and the merchant ships for training our Officers and men in practical seamanship. I am very pleased that Admiral Wilson and Captain Colomb alluded to the Australian service. I felt rather aggrieved at that omission by the essayist, because I was one of the youngsters that first joined the "Victoria,"[2] when sent out to Melbourne during the Crimean war scare. The small Colony of Victoria led the van in obtaining protection for the good ships and coasting vessels, &c., and we did coast-guard service, relieving ships in distress, going to wrecks, light-house, and light-ships, &c., and were, to all intents and purposes, a fighting ship, flying the pennant.[1]

[1] The gunner and a gig's crew, belonging to the "Cerberus," at Melbourne, about eighteen months ago, were all killed through the electrician (belonging to the Telegraph Department) allowing a sea cell to be formed whilst the torpedo was being laid out in the boat.

[2] The "Victoria" was one of that class of vessels that would be so useful even now—high speed, and capacity for carrying a few of the heaviest guns; in fact, an "all round" useful class of ship.

I think if we did not get very many seamen from the Colonies we would at least have a number of the ships relieved from those stations, for service elsewhere; and that the Colonies, with some little assistance from home, would be perfectly willing and capable of defending their own coasts. I have had some years' experience amongst Asiatics, and nobody has mentioned the great aid we could get, with regard to domestics and the class of non-combatants, by a judicious addition of Asiatics, and thereby supplement our strength of British fighting men. I ventured to jot down a few notes with regard to these matters, but as it is approaching such a late hour, perhaps if the rules of the Society will permit I would incorporate my few remarks in writing for the Journal. I think it would be more pleasing to the meeting, instead of detaining you by a *résumé*. I have travelled considerably, and have worked as an able seaman, and as an Officer on board merchant ships; I have travelled as a third-class passenger, and as a first-class passenger, and I have, to suit my convenience, even "worked my passage;" so that I should know something of the "forecastle" of merchant ships also. I know something of the working of Asiatic crews. There are certain points with regard to these that it is not expedient I should mention now, having regard to my position, but I believe a practical economical scheme could be brought forward for having a wide selection of men of a higher standard for our junior Officers; so perhaps I may be permitted to send in my remarks in detail hereafter.

The CHAIRMAN: The Council will consider it.

Sir F. NICOLSON: It is a very exceptional course.

Mr. PFOUNDES: What I wish to say now will only occupy a few minutes longer. In regard to sailors' homes and barracks, that subject has been already dealt with, but from my knowledge of the coasts of England, our Colonies, Europe, America, and other places where our Consuls have a great deal of trouble with seamen, it would be a very great advantage if something were done to employ seamen, while they are out of ships, in the way of training them, so as to try to get the merchant seamen out of the slums around the ships, and train them to make them suitable for any emergency, and a sudden demand for men. With regard to making the seafaring life more respectable and popular, so that mothers would not be afraid to send their boys to sea among disreputable lads, my scheme included this, and now that we have royal patronage, and pensioners to train them, instead of having to go back to street Arabs and refugees, I think we ought to be able to get respectable lads; in fact, I have reason to believe a good many of the unsuccessful "competition wallahs" of the lower division of the Civil Service would be glad to be pitchforked off to sea, especially whilst smarting under the disappointment of failure, if they thought there was anything like a fair field open for them amongst respectable men. There are other points I should much like to deal with, but I feel I ought not to trespass upon your time any longer this evening.

The adjournment of the debate, having been moved by Captain ARTHUR and seconded by Admiral WILSON, was agreed to, and fixed for Wednesday, the 14th instant.

Wednesday, June 14, 1882.

ADMIRAL SIR EDWARD G. FANSHAWE, K.C.B., in the Chair.

Adjourned discussion.

Captain ARTHUR, R.N., C.B.: The points raised by our Prize Essayist are so numerous and important that I think we shall best enter into your views, Mr. Chairman, as to the disposal of our time by merely discussing those on which we are best qualified to give an opinion. I commence with the first two: the age and method of entering naval cadets, and the training and education of junior Officers. I quite agree

with Admiral Luard that the first and most important point is to get the right kind of raw material from which we are to construct our naval Officers: for as certain as we are present this day, the next naval action, after a vain attempt to destroy one another at long distances, will be settled at close quarters, at high speed, and if a Commanding Officer loses his nerve for one moment, however good his crew and Officers may be, nothing can save his ship. Therefore I think it of the utmost importance to so select and train our Officers as to qualify them ultimately for command, taking care, throughout the whole of their career, to weed out such as will never have the requisite qualifications for that purpose. We have no way at present for selecting that raw material; the "Britannia" does not give it to us, and competitive examination will not give it to us. In the latter we have the test of brain power, but we have no criterion of physical power. Certainly there is a certain amount of physical development which is necessary to pass the medical examination on entry, but it is not such as we require for making a superior Officer where nerve is required. In the "Britannia's" course there is some power of selection, but the young lads there are already Officers in Her Majesty's Navy, and it would be cruelty to them, and in fact they would be disgraced for life, if they were discharged. Consequently they never are discharged, except for very bad conduct or intense idleness, or some great physical imperfection. Now I propose a remedy for this. Then it is proposed by Captain Brine, and supported by other Officers, to enter cadets later into the Service. Now this is a very important question: shall we adhere to the "Britannia," with an entrance at the early age of 12, or receive them direct from public schools at 16? I believe naval Officers are divided equally in opinion on both sides; certainly we have the example of other navies in which the later entry has been very successfully carried out, but I maintain that neither system will give us the power of selection we require; and I propose as a remedy to establish a school on shore, self-supporting, at which lads should be entered between the ages 12 and 13. Their education should be general, but attention be more particularly paid to their physical development, and strict discipline should be maintained. After they have been there three years, we shall pretty well know their characters, and could make a *limited* selection, but would undertake to say that at all events a large proportion of these lads should be taken into the Navy. The others, of course, who would have received a good education at a comparatively cheap rate, could go into other careers. I should then send those that were selected to the "Britannia," or to some similar establishment, for one year to learn navigation and other points in connection with a sea life. After that I would send them to sea. They would then be (say) 16, or from 16 to 17. After three years at sea I would examine them on board their own ships in navigation, seamanship, and gunnery, and rate them as Sub-Lieutenants; they should continue to serve at sea for two years longer, then join the college, and proceed with their studies for eighteen months to prepare for the examination for Lieutenant, on only such subjects as qualify them for that rank; because I propose to adopt the system which now obtains in the American Navy of examining Officers for every rank. I should also suggest that we might advantageously copy them in another respect, for in considering the number of years that a Lieutenant now holds that rank, would it not be advisable to establish the rank of Lieutenant Commander, to which they would be eligible for promotion after eight years' service? Of course many Lieutenants would thus be left behind in the race, and drop out, but their services could be utilized in the Coast Guard, or in other ways. Now as regards the method of recruiting, Admiral Wilson suggests that men should join the Reserve through the Navy. I have always been in favour of that, but I think it should be done through a training ship. We can train half as many boys again as we want, and let the remainder, at their own option, go to merchant ships, and be in the Reserve. But in order to do this we must insist that merchant ships shall have a larger proportion of Englishmen on board, as Captain Brine also suggests. Of course shipowners will say that this will increase the rate of wages, but the men would draw their pay as Reserve men, which is too important a point to be overlooked. As regards the inferior physique of the boys, which Captain Brine refers to, I think he has quite hit the principal cause of this defect, that is, the want of space for a growing youth during sleeping hours. I would also suggest that we should recruit more from the inland counties. I have generally found that a fair

proportion of farm lads turn out well. As regards the dependence to be placed on the merchant service in times of war, I think we must not expect merchant ships to become men-of-war. Their services would be very valuable in many other ways. In the way our guns are now mounted on slides, there is no trouble whatever in supporting the decks, so that they may carry four or six rifled 6-inch guns. I maintain that the whole of our steam mercantile navy should be armed in war time, and that they should be convoyed in squadrons of (say) ten, by vessels of the "Iris" class. As regards the Volunteer Torpedo Corps, General Schomberg very properly remarked that volunteers are not the people to handle torpedoes; but I think the Coast Guard might be found very useful in that respect. Admiral Boys, I think, said that our torpedoes are generally used from under cover of the forts; and the Engineers would then certainly be the proper people to have charge of them. But we also have mercantile harbours, and mouths of rivers, which could not possibly be defended by the Engineers, and in that and many other ways the Coast Guard might be utilized.

Major MOODY, R.M.L.I.: I would like to say a few words myself, but before doing so I have to ask permission to read a paper on behalf of a brother Officer who attended the discussion last week, but unfortunately cannot do so to-day on account of duty.

The CHAIRMAN: It is contrary to the practice to read such communications.

Major MOODY: On reading these essays, I feel that it is admitted on all sides that we want on board ship fighting men. At present it appears that the limit of seamen that we can obtain has been reached, without incurring considerable extra expense. That being the case, the Marines, with the non-combatants, supply the remainder of the crews of our men-of-war. The usefulness and efficiency of the Marines have been spoken of in high terms by the majority of essayists; but I think, from my experience, that the usefulness of the corps might be considerably increased. At present it is part of my duty to raise not only recruits for my own corps, but also artificers and boys for the Navy; and after two years' experience I find it is a very difficult matter to get the artificer class direct from the shore. Do what you may, it is rarely that you can get desirable men, and when they do come forward, they are frequently rejected for some physical defect, or fail to pass the necessary technical examination on arrival at the ports. I consider that a sufficient number of artificers might be induced to enlist in the Marines if some little encouragement were given, and thus we should obtain a very good class of men. I would not propose to form them into any separate body: they should be enlisted for the Marine Light Infantry, and they should then be trained in the usual way the same as any other recruits. After they were trained and reported fit in all drills they should be examined at the dockyards as to their fitness as artificers, and a list of them should be kept of those available for embarkation; and as the men are required, so they should be drafted into ships, and form part of the detachment. I do not see any difficulty whatever in the matter, provided of course the corps were sufficiently increased to meet the demand which would be made on it for these additional men. I find, on referring to a list I have kept for the last twelve months, that without seeking to obtain artificers, out of 1,131 recruits finally approved for the corps, 200 have been artificers who would fill ratings wanted for a man-of-war, that is one-fifth of the recruits. Of course I had no means of testing these men in their trades, but I take it that the men have no reason to tell what is false when they are asked the question, "What is your occupation?" on the enlistment paper, the truth of the answer to which they declared before a magistrate. I do not propose to fill the higher ratings direct: they might be promoted on embarkation if found qualified. Were my proposition adopted, instead of the large number of non-combatants you have on board ship now, you would have trained fighting men. Of course you could not do that without considerably increasing the Royal Marine Corps, as it is now as much as we can do, with the reduced numbers, to train the men ready to meet the requirements of the fleet. Captain Brine points out that the Marines are very valuable, because they can so very soon be increased in case of war; but that increase cannot suddenly take place. The raw recruits must be trained, and the least time in which you can train a recruit ready for embarkation is eight months; that is to say, four months' infantry, one month's musketry, and three

months' naval gunnery. At the end of that time he is fit to take his place on board any man-of-war as a trained fighting man. But that eight months is a considerable time, and a war would in these days no doubt be ended in half the time; though you might call upon recruits and readily enlist them, the occasion for their services would most likely be just before they were ready. Therefore, I think there ought to be more Marines on shore available for immediate service than at present. As to how you will dispose of these men, I know the usual proportion is half afloat and half on shore—about 6,000 of each; from the 6,000 on shore the recruits and casualties have to be deducted, which are always considerable. Should an increase of the corps take place, I would propose drafting some to the Coast Guard service, where they would be available for service, and be a useful addition. I am not intimately acquainted with Coast Guard duties, but I take it that the Marines might do Coast Guard work. Stokers are admitted who are non-combatants, whereas Marines are. You might take, say, 2,000 men for Coast Guard work; this would bring up the Coast Guard to 6,000 only, whereas it was thought originally it could be kept up from the fleet to 10,000—from the seaman class it appears difficult to keep it at 4,000; let them be on the same footing as the Coast Guard, and embark them from time to time with their ships. I consider in that way you would have a reserve of Marines which you could easily keep up. Another question is as to the entry of young Officers. Of course all the remarks that have been made here, and by the essayists, point to the entry of Officers for the Navy, but it is, I think, a very important point indeed that in a service that goes hand in hand with the Navy, and is created for the want of the Navy, the entry of Officers in the Marines should be taken into consideration. At the present time we are said to be officered with failures. I daresay you see from notices in the papers, from time to time, that in the ensuing examination for Woolwich and Sandhurst a certain number of Officers will be allowed to compete for commissions in the Marine Artillery and the Marine Light Infantry. Candidates are allowed to register their names for the Marines, but should they be what is considered lucky enough to qualify for Woolwich or Sandhurst, they are allowed to remove their names off the Marine list and accept the other. You may say to a certain extent those who chose the Marines are failures, although some who choose the Marines take high places. As a rule, I do not think for one moment that we are getting any worse Officers. In my experience—three years' experience as a gunnery instructor—I found all the young Officers who passed through my hands zealous and intelligent; and I hear those who have gone to the Indian Staff Corps have turned out most creditably, but it is the feeling outside the force. A distinguished Admiral asked me lately, "How is it you are officered by failures?" for he said that was the impression throughout the country. Of course people read these things in the papers, and form impressions which it is difficult to remove, and may prevent very desirable young men from coming forward. I should like to see a separate examination for the Officers of the Marines, and thus remove this impression, or make a man stand or fall by his first choice in the Army examination. In any case I should send those Officers, when they had passed, to Greenwich. It is a most important point that the young Officers should become acquainted with the naval Officers with whom they are to serve in future years. At present a young Officer of Marines embarks, after several years' service, a stranger to all those with whom he is called on to serve. If young Officers had one or two years at Greenwich, it would have a very good effect. Captain Brine says it is very desirable that a feeling of sympathy should exist between the trained seaman and the trained Marine; how much more desirable is it that sympathy should exist between the naval and Marine Officers. I had not the privilege of belonging to the old college, but I know that throughout the Service the men who were at the college always used to have a very kindly feeling towards each other. It has been said in the discussion that the worst of it is the Marine Officers have little or nothing do on board ship. There is no doubt about it that sometimes, unfortunately, their duties are circumscribed; but I think there are a great number of things that Marine Officers might do in addition to the important duty of attending to the discipline of their detachment. Several Officers have been called to the Bar, and were there any inducement, no doubt this number would be augmented. Again, they might assist in torpedo and gunnery duties,

in which many are now qualified. I had the privilege of going through a torpedo course, but I never saw a torpedo since I finished it. Efficiency in naval gunnery is greatly increased by the inducement of the additional 1*d.* a day recently given by the Admiralty on the recommendation of Major-General Adair, D.A.G., to the Light Infantry, and additional interest has been shown by the Officers, which I hope will be encouraged afloat. In recruiting for boys, the medical objection is the worst thing we have to deal with. Many a fine boy is rejected for a trivial cause. When a desirable boy is selected who comes up to the standard, in many instances some little defect causes him to be rejected; and I daily see boys go away from the examination rooms bitterly disappointed because they could not go to sea. Many of those boys would go to the "Warspite" or other training ship had they an opportunity; if this opportunity could be given, hundreds of fine lads could be trained for the sea. Desirable lads might be medically re-examined, and taken at a later period for the Navy if the original defect had not increased. Recently I saw 200 fine boys in the "Warspite;" the 15*l.* a-year expended by the Marine Society in training these lads is well-spent money. There was room for 400 on board, at least. Why not a dozen "Warspites"? It would repay the country in the end, and the wealthy shipowners ought to be glad to assist the Government and private societies in such an undertaking.

Captain NOEL, R.N.: After what we have heard from Admirals Wilson and Luard, and other distinguished naval Officers, there is not much left for me, a comparative junior, to say. There is one point, however, which should be most seriously considered; that is, the training of youngsters in their duties as naval Officers. Captain Brine proposes keeping them under training on shore, or at any rate not sending them to do Officers' duty afloat, until they are 19 years of age; I think that such an idea is unreasonable. Of all things most necessary for the training of a naval Officer this is chief, "that between the ages of 16 and 19, or we will say the last three years of a midshipman's time, the boys should be employed in sea-going masted ships, and kept at sea (when practicable in cruizers, or small vessels, but certainly *masted* vessels) and there they should learn their duties as Officers." If it is possible to reduce the amount of schooling they now have, so much the better; I entirely agree with Commander Grenfell in his view that by trying to make the midshipman work at seamanship and school study at the same time, neither one nor the other is mastered. If the cadets are sent to a training college until they are 16 years of age (whether entered there at 12, as Commander Grenfell proposes, or later as others suggest, does not much matter, though the later entry is to my mind preferable), they can be thoroughly grounded and required to pass a stiff examination in order to prove themselves fair mathematical scholars, after which we can afford to send them for three years to learn their duties as Officers, before passing for Sub-Lieutenant. In this rank, the present system of study and examination is all that can be desired; though in selecting for promotion too much doubtless now depends on the college examination, and this is a great tax on many young Officers. If it becomes recognized that the three years at sea above referred to are not to be three years of school work, we should settle down to a more uniform system of education. The boy who had proved himself a fair mathematician at 16, would readily pick up and advance on his back work, during the six months he has as Sub-Lieutenant, at college, and then he ought to pass just as good an examination as we get out of the young Officers now. As far as the state of the higher education is concerned, I may speak with the experience I have lately had, at the Naval College, and certainly the whole tone of the college, and the system of education, is on an admirable footing; this is very satisfactory. I am much opposed to what Captain Arthur just now suggested, that is, of having examinations to qualify Officers for the higher ranks; I do not think it would ever answer. I hold that it is for the Admiralty to select, not only the Officers for promotion, but also the Officers they do not want and get rid of them, obliging them to retire on such a liberal scale of retirement as they may fairly have earned by their services, that is what I should like to see, and in this way the lists might be cleared and kept clear. Examinations are often mere excuses for not advancing Officers, when really some of our best men will not pass them. With regard to the question of the entry of seamen, it would in my opinion be

a great mistake, if we ever departed from the admirable system of entering and training enough boys to fulfil the requirements of the Service. We do not want so many seamen as we did formerly; we should therefore find no difficulty in supplying the numbers required from the boys we enter. It may be that we ought to have more seamen than we have at present, and it would be certainly better if the crews of our ships were larger. Why they were originally reduced, I could never understand; in the first place, the number of guns in the old liners and frigates was reduced, then the crews; this was probably from reasons of economy; now it has grown into a practice, and crews are put on board ship, of only sufficient number to work the guns and machinery, whereas it is of very great importance that we should not have crews so limited in number that after a severe action we should find ourselves short of men; in fact, our ships should carry the fullest possible number they can stow, then we might look to having a reasonable force ready to be landed, if required. Look at Egypt! if we had five old line-of-battle ships there instead of five armoured vessels, there would be nearly double the number of men ready for landing. Next as regards the organization. On this point I rather agree with Captain Colomb, R.M.A., that hitherto organization has been almost a dead letter. But the difficulty is, that we have no head-centre from which to organize. There are the gunnery ships, with the gunnery people, all being chosen men of good character. Then the unfortunate "Duke of Wellington," and "Royal Adelaide," with the residue—mostly riff-raff, and men of inferior character—with whom the boys, just after a good and severe training, are associated, to be given lessons in worthlessness, before they go to sea. If we ever can establish barracks on a sound system, then we may look to have some organization. We can enter our boys, and have all the men and boys belonging to one port on one set of books, so that they can be sent in regular rotation to their various duties and employment, and we have all those remaining in the home ports associated and drilled together. In this manner we should be able to arrive at some sort of organization, which I imagine is a very difficult matter now. One thing I do hope, and that is that the organization, or rather *dis*organization, of the Sheerness Barracks will have no influence in the system to be adopted in the new barracks we hope to get some day. I am afraid that things there have not been as they ought to be; young ordinary seamen sometimes have remained there for three or four years together, and it has been the greatest possible harm to them. One of the principal objects of some of the Officers has been to get the men away on leave, having no employment for them; in my opinion there is lots that the men can do; let some of the ships in port be commissioned and sent to sea for a cruize, and back again, rigged and unrigged, everything being done by the men from barracks, so that no additional expense should be incurred. Let there be fifty, or even a hundred boats attached to the establishment, and one division of the men be constantly exercised in boats while other divisions are being drilled in gunnery and torpedo exercise, or are employed in useful work, in rigging lofts and other parts of the dockyard. There is plenty for the men to do, and if only the new system of naval barracks is properly organized, it will be a beginning, and I trust a good beginning, of sound organization in the British Navy. Before sitting down, permit me to congratulate the Institution on the essays, and to say how glad I am that the Council has caused those essays which were honourably mentioned to be published in the Journal; on the last occasion of competition on a naval subject, we only got one essay, and I thought that was rather unfair on the Navy.

Mr. LAUGHTON: When two or three months ago I gave a lecture here on Naval Education, and on the work of the Royal Naval College, I brought forward, as prominently as I could, the question of a later entry, which to me, from the instructor's point of view, seemed of almost paramount necessity. I am glad to find that not only most of the essayists but the distinguished Officers who have spoken in this discussion, looking from a very different point of view, have come to practically the same conclusion. I do not consider that this is the time to enter on a discussion of details, but the main features of what I and many others have proposed are that the age of entry should be considerably increased, and that the rudiments of mathematics should be acquired by a young Officer before he goes to

sea. Whether that is done as I proposed, at private schools, or, as Commander Grenfell suggests in his essay, at a Government school, is a matter of detail which will have to be threshed out when the question comes sufficiently before the Admiralty. Personally, I do not see any reason why, as Commander Grenfell suggests, the country should be at the expense of the elementary education of little boys for four years. He suggests entering them at 12 years of age, and continuing their elementary education for four years, before sending them to sea. My idea is that this elementary education could be just as well obtained on shore at the expense of the parents, without costing the country a farthing; and that then by competition in the first place, and afterwards by such sifting as was found necessary, the lists of candidates and young Officers could be cleared to any extent. Now, if that is, as has been shown in the course of discussion, the general idea of the Service, the difficulty is merely one of administration; and though this difficulty may be insurmountable just at present, it will certainly be got over in the course of a few years; and for myself, I think the sooner it is got over the better. One great difficulty in the way of any change seems to be a staunch conservative feeling. We enter the boys young now, and we always have done so, and whatever is, is right. It is therefore worth inquiring whether this is really true: is it, in fact, conservative to stick to this closely defined entry? Mr. Campbell says that during this century the age of entry has not varied more than one year. That is a mistake. Of my own knowledge, I can say that Officers now living entered very much more than a year later than the present limit, which is 13½; every one here probably knows Officers who entered the service at 16 or thereabouts. Only this morning I read in the *Times* the biographical sketch of that distinguished Officer who has within the last few days been suddenly taken from us. He entered the Service in his 16th year, that is, two years outside the present limit; and I know of many others, so that, within our own time, the limit of age has gone backwards. But independently of that, within certainly a hundred years, there was absolutely no limit of age whatever. It was customary, no doubt, for youngsters of good family to be entered as early as possible; whether they went to sea or not is another thing; in many instances they did not, but they were entered on the books of some ship, and their time counted: this was simply to evade the rule that a candidate for the rank of Lieutenant must produce certificates for six years' time at sea. But compared with the number of what were then called "quarterdeck petty officers," such instances were exceptional. Practically, a midshipman was entered into the Service at any age the Captain liked, and he was examined for the rank of Lieutenant at any age above 20. I know one case where a man was over 50 when he was examined. It would appear, then, that the limit of age is a comparatively modern thing, and when we say that we are sticking to the rule of our forefathers, my idea is that we are not. The sticking to that would be to allow boys to enter young or old, as they or their fathers liked. Our present system grew out of the old, and is a restricted form of one small portion of it; the limit of age is in reality the novelty; and in advocating the extension of that limit, I am, I conceive, arguing on a truly conservative basis. The value of the college examination, in regard to the promotion of young Officers, has been spoken of. Admiral Wilson expressed an opinion that the examination might very easily be estimated too highly. In that I would quite agree with him. It does not necessarily follow that because a man passes an extremely good examination in mathematics and things belonging to mathematics, he has therefore the making of a good naval Officer in him. I should rather, if it were possible, have the examination considered as a recommendation for appointments which might give him an opportunity of showing what he is really worth. I conceive that this would be better than promoting him off-hand. That a midshipman who has devoted himself more exclusively to the study of mathematics should, within a month or two after his examination, be sent to sea as a Lieutenant, perhaps in a large ironclad, without any possible experience, is, to say the least, somewhat risky. Commander Grenfell's suggestion, that boys should be entered by examination at a later age than now, appears to me worthy of consideration. It might perhaps be adopted partially, if not wholly. The present examination for boys requires that they should be able to read and write. But the very smallest qualification in reading or writing is not

unfrequently accepted. I gather this from the recent report by Mr. Harbord, the Inspector of Naval Schools. He thinks that the easy way in which the standard is tested is prejudicial. He says that the very small amount that is required, when it becomes still smaller by lax administration, speaks really of no parental care at all, and is no guarantee that the boy is the son of respectable parents, or anything better than a street Arab. We want the boys of respectable parents, a sufficient number of whom, Mr. Harbord says, are eager to come into the Service. Possibly if the standard of elementary education were increased, as well at the age, something might be done in that way. There is just one other point I should like to speak of. It is one that Admiral Wilson dwelt on—the passing of Reserve men through the Service. This seems to me to meet the difficulties that Captain Brine has spoken of, both as to the age of our men and their physique, as well as the difficulty that arises from the complete separation of the mercantile marine from the Navy, a thing that every true lover of the Navy must deplore. But I think I would go further than Admiral Wilson[1]—following up a suggestion of Commander Grenfell's—that when barracks are established, the Officers of the Naval Reserve should come there for their training, should be trained in company with the Officers of the Navy, should learn to know them, should have opportunities of forming friendships with them. If war broke out, these Officers of the Reserve would be called on to serve on board our ships; would it not be better that they should then come on board them knowing what a ship of war really is; that, in fact, they, as well as the men, should have passed through the Service? If an Officer of the Reserve had served a commission (say) as a Sub-Lieutenant, he would not only have passed through his drills, but through the discipline of a man-of-war; and if in a critical time he was called upon to do his duty as an executive Officer, he would not have to join his ship knowing indeed his duty as a seaman and gunner, but knowing nothing of the naval manner of life and of the naval spirit. It seems to me that in this way the Navy and the Reserve might be more closely bound together; and that one feeling of brotherhood might be extended throughout our whole maritime population, alike to those who serve the Queen, and to those who serve the merchants.

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Lieutenant CAMPBELL: It is with a feeling of considerable diffidence that I rise to join in this discussion, which I am sure will be long remembered by every one who has had the privilege of hearing it. The importance of the subject to the Navy, and to the public, combined with the known ability of those who have done the essayists the honour of discussing their efforts, will give prominence to this debate in the annals of the Royal United Service Institution. At first I must say I trembled for the fate of the essayists. It seems to me that if General Jomini himself, on the principles of the art of war, had calculated on the entire annihilation of the essays, he could not have formed a better plan of attack. Admiral Luard, Admiral Boys, and General Schomberg found the weak points in the essays, and column after column was poured down upon them, but I am glad to say, as the discussion is drawing to a close, that the main principles of the essays have not been attacked, nor, except in one or two instances, has the accuracy of the statements contained in them been questioned. There are one or two points with reference to the second essay which I will notice and endeavour to answer. Captain Colomb, R.M.A., has said, with reference to the essay by Lieutenant Campbell, that Lieutenant Campbell looked upon the Navy as perfect. Now I see that both Captain Seymour and Captain Noel have also drawn attention to the want of organization of the Navy, in some points. I would not like to state that any service under the Crown—I might say under the sun—is perfect. I am only sorry that any observation in my work should have led any one to believe I hold that opinion; and I am not at all sure that such perfection is necessary; but I must say and will maintain that, taking the statements as Captain Colomb put them, and placing them in the hands of a competent judge, the statement supposed to have been made by Lieutenant Campbell is as near the mark as that of Captain Colomb "that the Naval Service is the most ill-organized under the Crown." With reference to the speech of Captain Colomb, R.N., who not for the first time flashed a new light on the subject, he explained that while the merchant service had increased enormously, the cost of the Navy per head had been reduced. That is a very important point. It seems to have escaped the essayists, but probably it will be useful to those who may write on the subject in future. Again, he pointed out one of the most important things we have to do with, that is, the old seamanship and the new. He drew a very graphic picture of our receiving the new seamanship at the starboard gangway, and bidding goodbye to the old at the port gangway. That probably will be felt as a complex puzzle to naval legislators for the next century. It is not so much that we are loth to part with the old friend as that we cannot. While the "Dreadnought," "Thunderer," and "Devastation," and other mastless ironclads, are lying side by side with the "Carysfort," the "Inconstant," and other cruizers, while we have to train men to go in either class, while we economize fuel by making sail, and increase the fighting power of ships by taking away masts, we cannot say goodbye to our old friend; on the contrary, we must cling closer to him with all the tenacity in our power, and cherish him in the hearts of our Officers and men. With regard to the points that were thrown out for our discussion, they begin with the age and method of entering naval cadets. Mr. Laughton has very properly made some remarks with reference to the discussion that has taken place. With regard to the retention or doing away with the "Britannia," he seemed to place it on conservative principles, that she should be done away with. The conservative principles which I have always been taught to believe in, are that you should strengthen, amend, and improve in order to preserve; not that you should take a broom and sweep an institution away, and then go groping in the dark to get something in its place. It matters little to the country in the end whether the establishment is on a hulk or on shore, but we must have an establishment of some sort—either a conjunction of ship and shore, or some other well organized scheme for putting our naval education on a proper basis. The training and education of junior Officers I dealt with at considerable length, and gave, in my Table II, very much what Captain Noel has so strongly advocated to-day. I put an extra year in the "Britannia," which did not find favour with every one. Before I read Mr. Laughton's paper I was perfectly confident that the general impression in the Service was that more mathematics and general education ought to be given to boys before they go to sea, so as to relieve them from that branch when they are at sea. I propose

to send them straight from the "Britannia" to sea by means of training ships and cruizers, bringing them back at the end of their time, and placing them in ironclads. With regard to selected promotion of Sub-Lieutenants and Commanders, I believe most Lieutenants in the Navy are in favour of selection. I know of a Lieutenant who the other day went into his club, and said a batch of eighty-one was to be made. The members immediately got round him and asked how he knew it. "Oh," he said, "eighty-one have told me that they expect to be made next batch." Therefore it is probable that those eighty-one approved of selection. With regard to the permanent appointments of Captains and others to large ironclads, I think it is worth noticing what the word "permanent" means. The lives of our ships are growing longer and longer. If you take the "Minotaur" and similar ships, an appointment to them would mean for a life-time. I do not think such an appointment would meet the views either of the Officers or the country. With regard to the method of recruiting, I propose going more into the country and less into the towns. The other day somebody stated that one of the essays suggested bringing people from the workhouse. That certainly was not in my essay. I will now go to the enrolment of fishermen, and volunteer torpedo corps. A few days ago a remarkably clear, concise, and able paper was read by Lieutenant Sleeman on "Torpedo Warfare," when he explained the great simplicity that attached to it, and made it clear to every one present that it was not quite so impossible a thing after all to have our ports defended by torpedoes. I propose a Volunteer Torpedo Defence Corps to be raised in every port. There is not the slightest reason to give them materials or torpedoes until the time of war. If they are ready for the purpose I think it would be of material advantage to this country to be able to utilize them, every port having a large number of mechanics, boatmen, and others, who could with preliminary instruction lay down torpedoes, and if necessary, explode them. Before sitting down I should like to say how much good the writing of an essay does to the Officer who writes it. It is not so much what the public may learn or what may be taught by the essay, as the good that is done to the Officers themselves,—what they learn while composing, and what they read while they are writing; because I defy anybody to sit down and write an essay without consulting a large number of books, and I hope when this is better known that competitors for the Gold Medal of this Institution will number ninety-nine instead of nine. I thank the meeting for the kind hearing they have given me. There is one more point of difference which I have with Captain J. Colomb. General Schomberg foreshadowed the possibility of a war in the immediate future, and Captain Colomb said he hoped he should not live to see that day. Now, if for the defence of our Colonies, the honour of the British flag, or for the defence of our hearths and homes, this country should be called upon to make an effort, I say I hope Captain Colomb may live to see that day, and to find himself the victim of groundless alarm; I exist in the hope of seeing it, and hope to have the honour of being present, even if that day should be my last.

The CHAIRMAN: I think the discussion we have had has been in a very high degree valuable and satisfactory, in consequence of the great ability which has been shown, and also in consequence of the practicable nature of many of the suggestions which have been made. Also we have had the advantage of several speakers who, from the opportunities they have had, have been very specially acquainted with the particular points to which they have referred. I do not wish to take up your time with referring to details, but I will say that on each branch into which this subject is divided we have had much valuable opinion given. First with regard to the entry and education of Officers for the Navy: whatever differences in details have been shown, there has been a remarkable concurrence of opinion that the cadets should remain at least a year longer on board the "Britannia" or some such institution. Secondly, there has been, not a universal but a general expression of opinion that they should be taught practical seamanship and navigation in some kind of training ship. For my part, I entirely concur in both those propositions. I would add that I think the additional year in the "Britannia" should be devoted rather to a more complete grounding in elementary education than to any much more advanced and ambitious programme; and, in the instruction in the training ship, the utmost care would be necessary to render that instruction thoroughly systematic and

complete, both in seamanship and in navigation. I think, in seamanship, it should chiefly consist of oral instruction, illustrated by daily evolutions and manœuvres of the ship herself; and that those evolutions and manœuvres should form an essential part of the daily routine of the training ship. I think that instruction in navigation should be imparted by Navigating Officers in the Navy, not by Naval Instructors; it should consist very much of the pupils navigating their own ship, they taking their own observations by day and by night, and working them out under the supervision of their instructors. Blunders and errors would appear copiously at first, but I have no doubt that in less than a year these gentlemen would be competent to navigate a ship with very fair accuracy and trustworthiness. Should that modification in naval education be carried out, those gentlemen, at the age of about seventeen, would go into the general service of the Navy, far superior, in elementary education, in knowledge of practical seamanship, and in capacity to navigate a ship, to the acting Sub-Lieutenants who now, at the age of nineteen or nineteen and a-half, go to the Naval College. When those gentlemen, after two or two and a-half years at sea in the general service, went to the Naval College they would have two great advantages over the present acting Sub-Lieutenants. In the first place, they would be much better grounded in education, and therefore much better prepared to cope with the higher instruction which it is the business of the Naval College to impart; and secondly, they would be entirely exempt from the necessity of devoting a part of the time which should be given to higher studies to learning the rudiments of navigation, which the acting Sub-Lieutenants now have to do, although every one of them has in his possession a certificate that affirms, with a degree of inaccuracy very rare in the naval service, that they are competent to navigate Her Majesty's ships. There are two collateral reforms which, in my opinion, ought to accompany the proposed modification in naval education. First, when those gentlemen, at the age of about seventeen, enter the general service, the whole of their time would be occupied and required in learning and doing their duty as professional Officers; they ought not to be sent to school; and the rank of naval instructor, being no longer required, ought, in my opinion, to cease to exist in the Navy. Secondly, it would be a monstrous error, and worse than a monstrous error, if those gentlemen, at that age, on entering the service at sea were placed in a separate and inferior mess, dissociated from their older brother Officers, whose influence upon them would have the most beneficial effect in the formation of their characters, and in inculcating manly and Officer-like ideas. Any obstacles, therefore, that may exist, which if real are certainly not insuperable, to the formation of one well found mess for all Officers under the rank of Captain or Officer in command in ships at sea, ought, I think, to be overcome, and that measure should be adopted. Passing now to the efficient provision for seamen of the fleet, I think that there is a very general concurrence in approving of the system under which our lads are trained for the Navy, although some remarks have been made, and I daresay rightly, about the way they are crowded together in the ships at night. But a very great defect has been brought into prominence in the constitution of the crews of our ships at sea, namely, that from their extreme youthfulness they are deficient in physical strength to a degree which materially detracts from their efficiency. This may be accounted for by two drains which remove from the service of the fleet many of our seamen when they are in their fullest vigour of body, activity, and knowledge of a seaman's duty. Firstly, there is the discharge of those men who, at their own request, leave at the conclusion of their continuous service contract, at the age of twenty-eight; and secondly, there is the removal, which begins at the still earlier age of twenty-six, of some of the very finest seamen in the fleet, to the Coast Guard service, and therefore to the Reserves. Two remedies have been proposed, one in an essay, and another by one of the speakers, for the defect I have mentioned. One is that we should supplement the lads that we train ourselves for the Service by entering, under proper regulations, older and able-bodied seamen from the Mercantile Marine; which seems to agree, or to be capable of being made to agree, with the suggestion made here to-day, that some seamen in the Mercantile Marine should pass through the Navy. The other suggestion is that the time for continuous service should be increased from ten to twelve years, whereby the men would remain with

us at any rate until they were thirty, and there would be more probability of their remaining to get their pensions, as they would only have eight instead of ten years to serve for that purpose. There is a third method which might suggest itself, namely, the retaining in the general sea service of the men who go to the Coast Guard service, to a later age than the minimum twenty-six. But the extreme value of the Coast Guard service as a reserve, not only from the fineness of the men as seamen, but also from their being habituated to naval discipline, would make one very unwilling to suggest anything that could deteriorate in any possible way from their efficiency as men of the Reserve. But one speaker, in appreciating the very high value of the Coast Guard men as the representatives in the Reserves of naval discipline, suggested that it might be feasible to appoint a certain number of first-class steam reserve men from the merchant service, under proper restrictions and encouragement, to the Coast Guard, where they would become incorporated with that service and acquire, like Coast Guard men, the habits of naval discipline. If that were adopted, and I do not know there is any reason why it should not be adopted, then I think it would be very easy to retain in the general service at sea our best seamen to an older age before transferring them to the Coast Guard. Some valuable suggestions have been made to-day as to the efficient training of young seamen. I think that Sir Michael Culme-Seymour pointed out a very great defect that we have in our organization, by which masses of young ordinary seamen are kept in guard ships without being associated with older seamen or petty Officers: and Sir Michael told us very accurately the reason of that defect. I can say that whilst I was at Portsmouth there were 400 young ordinary seamen at one time in the flag-ship, of whom, on leaving their training ships, there were not more than 1 per cent. who had not got "very good" certificates; of those 400 young seamen I think about one-fourth had already got into second-class for conduct—not for really disgraceful conduct, but because, without leaders to keep them straight, they had got into that sort of scrapes which everybody in every profession is apt to get into between the ages of seventeen and twenty-two, and which we should be very sorry to have recorded against us on parchment for the rest of our lives. As to the Reserves, I think the general consensus of opinion, both in the essays and also in the discussion, has been that the sources from which they are derived, and their general quality, are excellent; in fact, I do not know that, even in a maritime country like this, we could produce a better body of men, or draw them from a better source. But there is less confidence as to their numerical sufficiency; and a very good recommendation was made, I think, that we should endeavour to get more artificers of the different branches into the Reserves of the Navy than we now have, considering how large a proportion of the complement of a fleet is taken up by artificers. Also it was suggested, and was urged with great force by Admiral Wilson—and no person is more capable of giving an authoritative opinion upon the subject than Admiral Wilson—that we should go to the Colonies to assist us in our Naval Reserves. The seafaring population of our larger Colonies would no doubt furnish a very valuable body of men; they are men who would, in some shape or another, be necessarily employed in the defence of those Colonies in time of war, and a large part of our fleet would also be occupied in the same duty. In fact, to state that proposition is to show that it is extremely desirable that those seafaring men of the Colonies should be associated in some way with the Reserves of the Navy for the purpose of the defence of the Colonies. I do not think I need occupy you further; I have touched upon what appeared to me to be the most salient points in the essays and the discussion, without going, or attempting to go, into any details. I will say in conclusion that I think the Council of this Institution is to be very much congratulated on the results that have attended the selection for the Prize Essay on this occasion. It has brought forth a mass of most valuable opinion from executive Officers of all ranks in the Navy—opinions which deserve, and I have no doubt will have, great weight and consideration, and will conduce to the benefit of the Naval Service.

SUGGESTIONS FOR IMPROVING THE EFFICIENCY OF THE *PERSONNEL* OF THE NAVY AND ITS RESERVES.

By Cyprian A. G. Bridge, Captain R.N.

"At once to preserve and to reform."—*Edm. Burke.*

The accompanying suggestions were written to be sent in as an essay in competition for the Gold Medal offered by the Royal United Service Institution. An unexpected appointment to a ship prevented the final revision of the essay until the date at which it could be received had passed. A few hours were needed to thoroughly complete it, and these have only been found within the last day or two. It is now submitted to the members of the Institution in the hope that the importance of the subject may render the collection of many different views on it desirable.

C. A. G. B.

January 27, 1882.

Summary of Suggestions.

1. Age of entry into the Navy to be raised from 14 to 16.
2. Nomination and selection of candidates to be rearranged.
3. Abolition of competitive scholastic examinations.
4. Examinations to be tests of education and capacity, not of superiority to competitors.
5. Early training to be technical, though not narrowly so.
6. Present undesirable combination of Officer and schoolboy to be discontinued.
7. Instruction in seamanship to be at least as definite and precise as that in mathematics or gunnery.
8. Scheme of early technical training to be based on the necessity of making good seamen, navigators, and gunners, not smatterers in mathematics and science.
9. Obligatory instruction to be the minimum requisite to make practical Officers.
10. Opportunities for voluntary study to be many; scheme of voluntary study to be comprehensive: such study to be encouraged, but not by promotion.
11. Dismissal of an Officer of several years' service for inability to pass a school-room examination to be made nearly impossible.
12. No promotion on any account to be given as a prize for success in mere examination.
13. Scheme of higher education to be twofold—general and special.

14. The former to be somewhat elementary, the latter greatly more advanced.
15. Examinations to be of two classes, the "pass" and the "honours:" the former to be obligatory up to the rank of Lieutenant; the latter always voluntary.
16. Prizes for success in passing to be pecuniary or appointments to special posts.
17. The vastness of our Navy renders necessary many distinct groups of highly-trained specialists. Putting all hands through the same mill a mistake.
18. Sea service (*bonâ fide*) to be encouraged.
19. Sub-Lieutenants to pass for Lieutenants.
20. Arrangements to be made with universities, colleges, &c., to receive Officers for training in special subjects.
21. Probable healthy effect of this on Greenwich.
22. Ranks to be multiplied.
23. That of Lieutenant-Commander to be introduced.
24. Commodore to be made substantive.
25. Commodores might be senior Officers of divisions of stations.
26. Title of Post-Captain to be restored to the Navy.
27. Rear-Admirals to be made by selection.
28. Duration of employment to accord with number of appointments available.
29. Many administrative duties now in the hands of pure civilians might be performed by naval Officers in time of peace. This would ensure the maintenance of a proper reserve of Officers and diminish the number of the absolutely idle.
30. Long unbroken periods unemployed objectionable.
31. Appointment to ships to follow immediately on promotion to any grade.
32. Vacancies not to be kept open long so as to promote "batches," but to be filled up at once.
33. No naval Officer should be in a post, not *bonâ fide* a sea-service one, too long.
34. Pay to be divided into "pay," "harbour pay," "sea pay," "foreign-service pay," for Officers and men.
35. Widows' pensions (as regards persons of all ranks entering the Service hereafter) to be abolished, except where the husband might choose to contribute during life to a pension fund.
36. Retirement of Flag Officers costly and unnecessary.
37. Lavish bestowal of increased rank on Officers retiring unjust to those continuing to serve.
38. The same general principles to be adopted as regards the civil branches of Officers.
39. Training of boys to be made more seamanlike.
40. Not so much school now wanted.
41. Abolition of seamen gunners as a separate class required by the circumstances of the time.
42. Service in harbour ships to be curtailed.
43. Crews occasionally to fit out their own ships.

44. Non-combatants too numerous, to be reduced.
45. Ships' corporals to be abolished; Petty officers to preserve discipline under master-at-arms.
46. Marines should not go to sea and keep blue-jackets in harbour-ships.
47. Marines might belong to armour-clads and harbour ships and a few to cruizers.
48. The garrisons of naval ports and strategic *insular* Colonies to be exclusively composed of marines.
49. A closer connection between the Navy and Merchant Service desirable.
50. Royal Naval Volunteers might take up torpedo defence of the kingdom.
51. Reserves of Surgeons, Engineers, engine-room artificers, stokers, carpenters, &c., wanted.
52. These might do 28 days' duty on board ships of war, corresponding to the drill of Reserve Lieutenants and men.
53. Reserve Officers might serve for short periods in the Navy.
54. Cruizers, as a rule, not to be attached permanently to foreign stations.
55. Such ships should be formed into a series of flying squadrons to visit all stations periodically.
56. Length of commissions to be reduced.
57. Commanders-in-Chief on certain stations to be stationary, as they are at Portsmouth, Devonport, &c.
58. Such Commanders-in-Chief to be Governors of certain strategic *insular* Colonies.

In the attempt to find out the "best method of providing an efficient force of Officers and men for the Navy, including the Reserves," two distinct lines of investigation may be followed. First, we may try to devise a wholly new system. Secondly, we may endeavour to retain the greater part of that already in existence, improving it, and adding to it where necessary. Had we to deal with a force of recent origin, or one which had only of late years attained any considerable proportions, the former course would have much to recommend it, and would probably be the best that could be adopted. But the British Navy is an ancient service. Its traditions, its history, its administrative continuity, go back for centuries. Not only will it be wise and statesmanlike to take advantage of the immense stability which the whole system has thus acquired: it would, almost of a certainty, be impossible—and, were it not impossible, it would very likely be ruinous—to endeavour to root up so vast an organization of so old a growth, however promising might seem the prospect of putting an improved establishment in its place. The phrases "custom of the Service," "laws and customs used at sea," and the like, have a significance in our Navy which they cannot claim elsewhere; and it is our good fortune that we are, to a great extent, governed by usages rather than alto-

gether by detailed and comprehensive regulations. Usage and custom in reality express agreement with their dictates on the part of those who are governed by them, or they would soon be altered; and such agreement renders infinitely more easy the maintenance of discipline and efficiency than even the most implicit obedience to orders extorted by force of rigorous and minute rules. This is especially the case with Englishmen. This essay will accordingly proceed on the principle of retaining intact, as much as possible of our existing naval system, and of pointing out where alterations and additions appear desirable and likely to introduce improvements.

It must not, however, be forgotten, without noticing those in its *matériel*, that the British Navy has undergone—often to its manifest advantage—many and considerable changes. The introduction of the "continuous service system" was in reality revolutionary in its scope. The system of training boys has in some respects completely changed the character of the Service. The education of Officers, from the first foundation of the Royal Naval College at Portsmouth in the early part of the eighteenth century, has been modified repeatedly. The civil branches have been frequently reconstituted; the relations of ranks have been revised; new branches of Officers have been introduced. The history of the quarter-deck has been followed in these particulars by that of the lower deck; and we find on the latter ratings and occupations, and, indeed, whole classes of men unknown there fifty years ago. The institution of an adequate reserve of Officers and men can scarcely be carried back as far as the Crimean War; and the changes in it have not been few or unimportant. Many of the reforms indicated have been specifically introduced by authority at short notice, and have not been the result of slowly changing circumstances. So that precedent and experience confirm the belief that, on occasions at least, great changes may be beneficially introduced into the organization of the Navy.

I. Officers.

A. Military Branch.

1. *First Appointment and Entry into the Service.*

All the changes made in the system of training Officers of the Navy within the last five-and-twenty years have proceeded on the assumption that a higher standard of education than was insisted upon formerly is desirable. The institution of the "Illustrious" and the "Britannia," the alterations in the College examinations, the additions to the number of subjects in which candidates at the latter are expected to be proficient, the reconstruction of the gunnery course, the establishment of the "torpedo course," and particularly the foundation of the great College at Greenwich, are all proofs that the object aimed at has been to extend the scholastic education of Officers. Several of the incidents just enumerated are not directly connected with purely naval training; though, no doubt, each and all may have tended to advance it, some of them considerably. In fact certain branches of knowledge, instruction in which can only be imparted in

the study and the lecture-room have—owing to the progress of naval science—become essential features of the education, if not of a mere seaman, at least of a naval Officer. To ensure success to any scheme of education pupils should be properly grounded in the subjects embraced by it. If they are at good schools, removing them at an early age to one intended to give a special direction to their studies, which are therefore necessarily narrowed, can hardly fail to have an unfortunate effect. The present age of entry into the Service is, on the average, just under thirteen. Putting a boy into the Navy at this tender age when it was done with the intention of familiarizing him early with the incidents of life at sea and making him acquire a knowledge of seamanship as soon as possible, had much to recommend it. But now that the first years of a youngster's career in the Service are spent wholly in the school-room, and several of the subsequent years principally in book study, unsettling him by changing his place of education cannot easily be justified.

The age of entry may with advantage be raised; and the period between fourteen and sixteen may be fixed as the one within which a boy should be eligible for his first nomination. This would make the average age of entry into the Service fifteen, at which, if the boy have had anything like the education that one of his station and proposed future occupation should receive, he ought to be thoroughly grounded in all the necessary branches of knowledge. If he be not so grounded by that time, keeping him till any later age at which he would still be properly admissible, would not be likely to bring up his fundamental knowledge to the requisite standard. A lad not sufficiently educated at fifteen must either be altogether unfit intellectually for the Naval Service, or have been so neglected that it would need several years more to prepare him for it.

Probably for every active profession school-room and literary examinations as tests of a youth's fitness, are unsatisfactory. At the best they are merely a convenient method of finding out something about some of the qualifications of the candidate. In reality, what they chiefly tend to establish is his power of answering questions of a certain kind. It is now a recognized fact that youths can be trained for examinations so as to get through them creditably, their general education remaining at the same time very imperfect. This vice of scholastic examinations as tests of fitness is inherent even in those which are obligatory on entrance into the regular scholastic professions. The ill effects must therefore be much more serious when entrance into professions which have little or nothing to do with literary or scholastic qualifications depends upon them. Examinations, that is, inquiries into the aptitude of candidates, are unquestionably necessary in the case of all vocations. As a matter of fact, no man of ordinary prudence engages any one in his personal service without making as complete inquiry as possible into his character and qualifications for the duty he wishes him to perform. This inquiry is not directed to his qualifications for some totally different employment. It is singular that in the present competitive literary examinations to which aspirants for the public service have to submit, we are content

with a mere formal certificate of that most important of all the qualifications which an Officer can possess—sound morals or good character, and take great trouble to find out what is his knowledge of certain subjects with which he has, when once in the Service, no further concern, except as regards their help to him to get through subsequent examinations of similar kind.

Candidates for nomination to naval cadetships and other first appointments in the Navy should produce satisfactory evidence of good character, of sound physical condition, and of having received an education suitable to persons of their years and station. The first of these must be derived from the reports of those to whom each candidate is known; the second can be easily ascertained by strict medical inspection, as at present; the third can be only imperfectly ascertained, and can only be discovered at all by examining candidates as to their attainments, not as to their superiority to other competitors, in those branches of learning which are taught at any good school to boys of the class from which Officers are drawn.

The question of entrance examination is intimately connected with that of first appointment, whatever branch of the Service be considered. They cannot be properly discussed apart. The institution of a purely open competitive examination disposes of all difficulties as to nomination of young Officers. But if it be held that a competitive literary and scholastic examination is a specially undesirable method of selecting candidates for the most distinctly non-scholastic of professions, and that it is sure to exclude from the Service many lads eminently suitable for it, the question of nomination, as well as that of examination, has to be faced. Proceeding on the principles of inquiry as to fitness for the Service already laid down, viz., that each person appointed must bring conclusive testimony as to his good character, must pass a strict medical inspection, and must satisfy the authorities that he has received a suitable education, and has intellect sufficient to reasonably profit by it, a scheme for nominating candidates to cadetships may be drawn up.

From each of a certain number of high class schools, amongst which those that are specially intended for the reception of sons of Officers of the Army and Navy may be included, a list of names—three for each appointment—of boys desirous of entering the Service should be sent in by specified dates to the Admiralty. Each name should be accompanied by a certificate as to character, special testimonials to the same from suitable persons, a statement of each boy's place in the school and in his class, and certificates from the head master and the boy's particular tutor, that his educational acquirements are such as are suitable to his age and station in life, and that his general conduct and abilities render him a desirable lad for the Service. When the Admiralty, or some Committee specially charged with the duty, should have selected one from the three whose names might be submitted, and not till then, all so selected from the several schools should be examined, not as competitors, but as to their knowledge in—

Latin,
Greek (plane trigonometry may be substituted for this),

One modern language,
Arithmetic,
Algebra to quadratic equations,
Euclid (Books I to IV),
English History,
Geography,
Dictation and handwriting.

These subjects are selected solely because they enter into the *curriculum* of studies of gentlefolk in this country; and every boy with any prospect of becoming a naval Officer may be presumed to have been taught them.

If the result of the examination should show the education of the boys to be such as their ages and social position demand, they should receive appointment as naval cadets.

2. *Early Training.*

The object of any special school or college for training the young aspirants to a profession is to fit them to become useful members of that profession. The continuation or completion of their general education is only indirectly an object of a special training establishment. If, as is probably the case with our second class boys—as certainly was the case before the legislation which made school boards general—the youngsters to be turned into seamen would receive little general education elsewhere, it should be provided for them in the special training ships instituted to train them for a seafaring career.

Boys' training ships are therefore not solely special schools, they are also places where general primary education is provided for pupils who would in most cases—at all events it was so when these ships were first established—not be taught properly or at all anywhere else. But the conditions imposed on those who desire to enter the Navy as Officers involve as a matter of course the possession of a proper education of a general nature. It is, consequently, no part of the business of the State to continue to boys of superior parentage and comfortable position that general education which their circumstances enable them to obtain in the ordinary schools of the country. It may seem at first sight a paradox, but it is perfectly true that the more credit a Government training establishment for Officers obtains for the general education it imparts to the youths who go through its course of study, the more distinctly does it violate the principles on which it should be worked. Special training, not general education, is the proper business of such an institution. Not a subject should enter into its obligatory *curriculum* that does not, with some directness, tend to improve the technical knowledge of the pupil.

No doubt in cases in which for the benefit of the State, or for what is supposed to be for the benefit of the State, boys are taken into the public service at an age at which their general education must necessarily be incomplete, the State is bound to see that they do not suffer from this early severance from the studies which are universally accepted as necessary for persons of their class. If, therefore, the age

of entry be very low, the obligation of doing ordinary schoolmaster's work is laid upon the Government; and as the latter professes at the same time to act as technical instructor, the chances are many that—having to perform two parts—in neither will it be very successful. This must be regarded as a strong argument in favour not only of fixing the entry into the Service at a reasonably high age, but also of limiting the subsequent instruction to what is really technical, though not necessarily narrowly so. Whilst in order to prevent mischief being done to those whose only fault—if it be not their misfortune—is an early entrance into the public service, facilities should be given to them of improving their general knowledge. If it be closely examined, probably no circumstance will exhibit more clearly the unfortunate effects of a premature removal of boys from ordinary places of education, and of the denial to them of the means of supplementing the narrow technical instruction which is all the Service as yet gives them, than the difficulty experienced by naval Officers, discharged under the many "retirement schemes" with which late years have made us familiar, in obtaining employment in non-nautical occupations. The great body of employers, among which departments of the Government are to be included, will not believe that they have received a suitable education. It is supposed, in fact, that they have been only technically trained, not generally educated.

It has been necessary to argue at some length on behalf of the view that the age of entering the Navy should be raised until the young aspirants to a naval career have completed at least the earlier stage of their general education; and that the only course of instruction which they should be subsequently compelled to go through ought to be simply a technical one. Writers of essays like the present are obliged not only to suggest schemes of reform, but also to fortify their suggestions by argument. The selection and training of Officers are the true foundation of any method of providing an efficient force.

Fifteen has been chosen as being about the age at which a fairly educated boy may be supposed to be adequately grounded in the several branches of an Englishman's education. His intellectual condition at that age should be, and as a rule probably is such, that to his studies may thenceforward be given a special direction. If he then enters the public service the State is not bound to act the part of ordinary schoolmaster to him. It need only train him technically for its special advantage, and give him facilities for increasing his general knowledge for his own. The Government, as relates to the young cadet, has consequently this problem before it:—To make him as nearly as possible a perfect naval Officer, and to allow him to become, if he desire it, a man of culture. There is universal agreement as to one qualification being essential to the naval Officer, that is, that he should be a seaman. This is indispensable; other qualifications of perhaps but little less importance may be safely distributed amongst the whole body of Officers. If all the Officers of a ship are good sailors, the efficiency of the ship will be well maintained if only some are good navigators, some good gunners, some good torpedoists, &c. But if all were good gunners, or good torpedoists, the very safety of

the ship would be threatened were there only one good seaman amongst them. Seamanship, of course, has a somewhat wider signification now than it had half a century ago; and in it is included a certain acquaintance with the working of the propelling power of the present day, viz., the steam engine.

It may be assumed that to be a good navigator, is also to be expected of every Officer. It is not by any means necessary, were it possible, which it certainly is not, that everyone should be profoundly versed in the theory of navigation and nautical astronomy. Some of the best and most fearless navigators known were—indeed many of them still exist—void of all mathematical knowledge but such as was conveyed by the "rules of thumb" of the older treatises. All that need be exacted from any Officer in this matter is, as has been well said by a very distinguished member of the civil branch of the Service, the faculty of being able to do duty as a prize-master. If an Officer can navigate a prize from the Pacific to England, his knowledge of navigation is for general purposes sufficient. Like seamanship, navigation has of late years become more comprehensive, and includes a certain moderate acquaintance with weather lore and sea geography.

If the man who is a seaman and a navigator can handle his ship under any circumstances and take her to any place desired, to be a thoroughly efficient Officer he should be able to fight her. The three weapons of modern times are the ram, the gun, and the torpedo. The power of using the first must be credited to anyone who may be regarded as a good seaman. To use the others requires some special training. To handle the offensive torpedo or guard against it, the operations of torpedo warfare which chiefly concern people on board ship, good seamanship is essential; and an Officer with a capacity for manœuvring a ship or a boat will almost certainly be a very efficient practical torpedoist even if his knowledge of electricity and explosives be small. There is, on the other hand, no necessary connection between gunnery and seamanship. A distinct course of instruction of a somewhat extended character is consequently indispensable to impart a suitable knowledge of the former to the general body of Officers, however excellent they may be as seamen and navigators.

We have now enumerated the three essential qualifications of a naval Officer; he should be a good seaman, a fair navigator, and a well-trained gunner. The first step in "providing an efficient force of Officers" for the Navy is to see that, as far as possible, each one of them should be all of these. To become a seaman, having once entered the Service, he cannot go to sea too soon. The two years during which he has remained at school longer than cadets do at present will have enabled him to acquire all and more than all the knowledge that would be imparted to him in existing school-ships. Having received his appointment, he should be sent to a sea-going training-ship for one year to cruize in the Channel, about the British coasts, to Lisbon and Gibraltar, and perhaps as far as Halifax or Bermuda. This ship should carry a suitable staff of instructors in the several divisions of seamanship, navigation, and gunnery. Each cadet should be put through a distinct class of instruction in those subjects.

The seamanship course should comprise :[1]—

I. Sedentary Seamanship—
1. Sea terms.
2. Knotting, splicing, &c.
3. Rigging, strength of gear, purchases, &c.

II. Active Seamanship—
1. Practical work aloft, reefing, furling, &c.
2. Managing a boat under oars, sail, and steam.
3. Steering, use of the lead.
4. Performance of nautical evolutions: tacking, wearing, heaving to, taking in sails, &c.
5. Rule of the road at sea.

III. Elementary Tactics.

At present there is no pretence at systematic training of young Officers in seamanship, and the adoption of some such scheme as that just specified under able instructors, would be sure to result in imparting to them a useful amount of knowledge. The steam course should be subsidiary to that in seamanship, and should comprise instruction in elementary knowledge of steam.[1]

1. Names of parts of engines, boilers, &c.
2. Methods of firing, raising steam, &c.
3. Course of steam from boiler to engines, its action as motive power.
4. Starting, stopping, reversing engines, &c.

The instruction in navigation should be directed on the principle of imparting to the students sufficient knowledge of mathematics, navigation, and nautical astronomy to enable them to solve problems of the class included in the old "College Sheet." It should comprise :[1]—

I. Elementary Mathematics and Physics—
1. Algebra to simple equations.
2. Plane trigonometry.
3. Elementary physics.

II. Navigation—
1. Definitions.
2. Use of compass, log, &c.
3. The sailings.
4. The day's work.
5. Use of a chart.

III. Nautical Astronomy—
1. Definition.
2. The sextant, chronometer, artificial horizon, &c.

[1] Here and in other places, where lists of subjects are given, the intention is merely to give a general idea of what the *curriculum* suggested should be like. No particular item is insisted upon or excluded.

3. Practice in taking observations.
4. Finding the time.
5. Finding the latitude by meridian altitude of the sun or other body, by double altitude, by pole star.
6. Finding the longitude by chronometer (not by lunar of any kind).
7. "Sumner's Method."
8. Finding error and rate of chronometer.
9. Variation of the compass—amplitude, azimuth.

IV. Pilotage—
1. "Swinging" ship.
2. Reading a chart, marking of buoys, beacons, &c.
3. Lights, buoys, leading-marks, &c., of Portsmouth, Plymouth, or some specified port or ports.

The gunnery instruction should include:[1]—

I. Gunnery—
1. Gun drill, target practice, &c.
2. Fuzes, ammunition, &c.

II. Small Arms—
1. Cutlass drill.
2. Rifle drill, target practice.
3. Squad and company drill.

The above course of instruction in the several divisions of knowledge considered necessary to a Naval Officer contains little which was not taught in well-ordered ships in the days when there was no "Illustrious" or "Britannia." The addition of two years to the age of the youngsters for whose training it is proposed, and the superior education which that addition is likely to ensure would, without doubt, render a more extended *curriculum* perfectly manageable. The principle, however, on which the scheme of instruction submitted in this essay is intended to rest is: that the obligatory training should be the *minimum* requisite to turn out efficient Officers, and that they should be both enabled and encouraged to improve their knowledge of special subjects. This will be more fully explained as the essay proceeds. Though the course detailed is not an extended one, the provision of a special training ship with an adequate staff of instructors ought to make it a thorough one; and no one will doubt that an annual supply of lads thoroughly trained in the three departments above mentioned would be far more useful to the Service than the same number of youngsters with a smattering of a multitude of subjects.

Every one should be compelled to pass through the course as laid down; and voluntary study in other matters, or in the same carried farther, should be encouraged. Means of studying foreign languages, mathematics (pure and mixed), natural science, theoretical navigation, and nautical astronomy, surveying, naval architecture, drawing, and

[1] See note to proposed Seamanship Course (p. 633).

perhaps other subjects, should be provided. At the end of the first six months, the cadets should be examined in the compulsory subjects, and if any were found unsuited to the Service they should be removed from it. Examinations should be held also to test the proficiency of those who had chosen to take up voluntary subjects, and for these prizes should be offered. Examinations of a similar description should be held at the conclusion of the year's cruize. The position of the candidates on the seniority list might be determined by the manner in which they acquit themselves in the obligatory examinations. Prizes should be again offered for the voluntary ones. It should be laid down as a rule, never to be infringed, that success in purely scholastic examinations should be rewarded only by prizes, which might be as handsome as desired, and by appointment to special positions. *Taking a high place in such competitions should never carry a right to advancement in the Service generally.*

Previous to the examination at the end of the year's cruize in the training-ship, the lads on board should strip the ship and re-rig her for the next annual trip. If two batches entered in a year, each cadet would thus have an opportunity of seeing a vessel rigged and unrigged, what few Officers see now. The examination should then be held, and those who pass should be rated "midshipmen," and be granted one month's leave of absence, and be then appointed to regular seagoing ships.

Perhaps it need hardly be said that it would be very advantageous were there more than one cadets' training-ship. If the number on board under instruction be very large, proper supervision by the Instructors is difficult, if not impossible; and if there be several establishments, there is sure to be a healthy rivalry between them, which cannot but tend to efficiency.

3. *First Years of Actual Service.*

The present system of bringing up our young Officers renders it necessary to employ them chiefly in large armour-clads. At the beginning of 1881, out of 269 midshipmen attached to ships, 152 were serving in large armoured vessels. The object of this is, that they may be placed under Naval Instructors. Every other advantage that they might gain by being on board ships of a more truly seagoing class is sacrificed, that they may be kept closely at school to study subjects which, however indirectly beneficial, are not absolutely essential to the training of a naval Officer. The stoppage of their general education at an early age no doubt necessitates this to a great extent; and the attempt which has been made to combine in our midshipmen the incompatible characters of Officer and schoolboy is due chiefly to the extreme youth of those who join the Navy. If the age be raised, one reason for maintaining the present schoolboy system would disappear. It has been asserted that the endeavour to instruct midshipmen afloat in subjects beyond the elements of navigation and nautical astronomy has almost invariably failed. The fact that before they are expected to pass the obligatory examination

for the rank of Lieutenant they have to study for six months at the Royal Naval College, may be accepted as a proof that, except in instances too rare to alter the aspect of the case generally, the school-work in seagoing ships is not credited with any value at all. Under present conditions, therefore, a six months' course at Greenwich is regarded as necessary to enable candidates to acquit themselves properly at the somewhat exacting examinations now in force. If the compulsory examination in future be altered to one somewhat of the character of the old College examination, that is, to one which should be arranged to test an Officer's knowledge in the subjects only which are really necessary to enable him to perform his duty, the actual six months' College course will, no doubt, more than suffice to enable him to pass it.

The midshipman may consequently be appointed to a ship of any class, provided she be a *bonâ fide* sea-going craft. In her, or still better in her and also in at least one other of a different class, he should serve for four years. At the end of two years there should be an intermediate examination of seamanship, gunnery, steam, and navigation, conducted by the Officers of the ship. During the four years he should be obliged to take an active part in the navigation of the ship, working the full day's work and observations daily, and assisting the Navigating Officer both at sea and in harbour. His gun-drill (in the comprehensive sense) should be regularly attended to; and, when it is remembered how successful the Gunnery Lieutenants of sea-going ships are in turning out "acting seaman gunners," it may be confidently looked for that at the end of the youngster's four years' time, his knowledge of practical gunnery will be considerable.

4. *Examinations and Higher Technical Education.*

On completing the four years' time, he should be examined in seamanship and elementary steam as at present, in gunnery, and navigation; and, if successful, be granted a certificate stating his ability "to perform the duty of *Sub*-Lieutenant in any of Her Majesty's ships, *and to take charge of a watch at sea when, in the opinion of his Captain, his being so employed may seem advisable.*"

On return to England, he should proceed to Her Majesty's ship "Excellent" for a three months' course of gunnery, to enable him to attain proficiency in those drills and cognate subjects which cannot be properly taught in most real sea-going ships. The examinations at the end of this period should be of two kinds:—

1. A "pass" examination without classes, which should be obligatory.
2. An "honour" examination with first, second, and third classes, which should be voluntary.

Prizes should be given to those who come out best in the "honour" examination, and it should be understood that candidates for the position of Gunnery Lieutenants would be chosen only from amongst those who had passed with honours.

The next step should be a four months' course at the Naval College.

This also should be followed by "pass" and "honour" examinations.[1]

1. The "pass," obligatory examination, the same as the old "College Sheet," with the addition of a few questions in meteorology and physical sea geography.

2. "Honour" examinations in three classes in different "schools," in only one or two of which a candidate would be examined; say:—

I. Mathematics, higher navigation, &c.
II. Physical science.
III. Naval architecture and steam.
IV. Naval and maritime law, naval history, and languages.
V. Hydrography, surveying, meteorology (and other schools, if thought desirable).

To qualify for admission to the "honour" examination, candidates should, two months after joining the College, pass a "previous" examination, which ought to be at least equal in severity to the "pass," and should entitle any who might fail at the subsequent "honours" trial to at least the ordinary "pass" certificate. Passing the "previous," should free the aspirants to honours from the obligation to present themselves for the "pass" examination. To those who might acquit themselves creditably at the "honours" examination",[2] prizes not inferior to the rewards now offered should be given; and they only should be eligible as students desiring to become Torpedo Lieutenants, as Navigating Officers, as surveyors, and to hold other special appointments.

The advantages of arranging examinations in the system suggested may be pointed out. The only uniform test to which every one would have to submit has been intentionally made a low one. Dismissal from the Service, after passing five or six of the freshest years of life in it, because of inability to pass an essentially scholastic examination, would naturally be rarer than now.[3] The particular bent of individual genius would be recognized, and the development of special aptitudes encouraged. It cannot be too often stated that the British Navy is a great service with the most varied interests. It is not a single regiment like the Royal Artillery, or a corps like the Royal Engineers or Royal Marines. It should have in its ranks not a number of Officers with a smattering of a multitude of things, but many groups of Officers, in each of which groups some special excellence might be looked for. Naval Officers cannot all be perfect linguists, first-rate mathematicians, learned physicists, well-trained naval architects, thorough marine engineers, &c., in addition to their ordinary Service qualifications. But naval training may be so arranged that it will be within the power of one in authority to point to one list of Officers and say, "Here are the names of those from whom I can make a selection for

[1] See note to proposed Seamanship Course (p. 633).

[2] To those who passed the "previous" with credit, extra time before going up for the "honours" examination might be given. The latter need not, perhaps, be held till after six months.

[3] Is it too much to say that such dismissal should be made next to impossible?

such an appointment;" to another and say, "From the names on this list I can choose an Officer for such another appointment."

Moreover, the system affords the means of obtaining an admirable class of recruits for several of the more important departments of the Naval Service of the State which are, as it were, outside the regular Navy. A young Officer of one or two and twenty, who had been five years actually at sea, had been brought into contact with foreign fleets, had personally observed the capabilities of many harbours, and who had passed with honours in one or more of the "schools" at Greenwich, might with great advantage to the Service be permitted to undergo an extended course of instruction at the College with the object of becoming a member of the Constructor's Department, or, possibly, of that superior class of marine engineers which, in the opinion of some, the Navy must eventually count upon its list. No one will doubt that the Service would derive benefit from this. Many an Officer who has high intellectual attainments, and the bent of whose genius has a scientific or mechanical direction, but who has not the inexpressible quality which fits men for command, or who, having the latter, desires for sufficient reasons to remain in England, would not—were the plan now submitted adopted—be compelled, as he is at present, to linger in the lower ranks, or leave the Service altogether greatly to its disadvantage.

The higher education of Officers should be organized throughout on the method suggested. No one should be compelled to submit to examination in any subject embraced by it; but every commissioned Officer in every grade of every branch of the Service should (of course under suitable regulations) be not only permitted, but encouraged to avail himself of the instruction given, and to offer himself as a candidate for honours and prizes—which ought never to take the form of immediate promotion in the Service—at the examinations in the several "schools" or departments of study. The objects of the "higher education" of naval Officers are two: the elevation of the general culture of the Service, a factor in morals of incalculable importance; and the formation of groups of Officers, the number of the members of any groups being small relatively to that of the members of the Service in general, in any one of which might be found the special knowledge and trained aptitudes desirable in persons called upon to fill those particular offices, the existence of which the vast extent and varied interests of a great service like the British Navy must always render necessary.

The scheme of higher education must therefore be divided into two parts; in one the instruction given must be general, in the other special and precise. No man of the world, with opinions founded on actual and wide observation of his fellow-men, need be told that specialists and those who desire to become specialists are few. The mere schoolmaster may try to make all those for whom he can originate and draw up a course of instruction specialists of a single type. Their natural aptitudes he cares not to consider.[1] Many men not beyond

[1] "Nature was of no consequence at all. No matter what a young gentleman was

middle age must recollect a time when at what were thought the best schools the instruction was, in effect, restricted to the study of Latin and Greek. A boy with an extraordinary genius, say, for mathematics, or for practical mechanics, was made to grind almost solely at the dead languages. The institution of what is called the "Modern division" at some of the new joint-stock schools—in which those of older foundation imitate them—was less a reaction against the old exclusive classical training than a survival of the disposition to turn all boys into specialists of a single class; so that a lad with a decided turn for, say, historical or linguistic studies, is made to grind at trigonometry. It is evident that we must not allow shore-going schoolmasters[1] to have too much influence when a plan of education for naval Officers has to be devised. When this is being done their place is not that of the judge, but of the advocate. Hear what they have to say by all means, and be guided in coming to a conclusion by their statement of what is, most truly, their case; but do not let them give the decision. Experience has already shown the necessity of taking such a precaution.

Let the following stand as a sketch of the mode on which the higher education should be planned:—

There should be two divisions—

I. The General.
II. The Special.

The object of the "general" is to extend the knowledge of all, or of the majority of the Officers, and to enable them to keep up their acquaintance with those subjects which they must be, to some extent, conversant with to perform their duties efficiently.

The course should last, including such holidays as may be thought needful, for one year. It should embrace the following subjects:[2]—

1. Navigation and nautical astronomy.
2. Natural science (those branches of it which are connected with the usual gunnery and torpedo studies).
3. Modern languages.
4. Steam and tactics (or tactics separately).
5. Drawing of both kinds.
6. Naval history, naval, maritime, and maritime international law.
7. Mathematics, pure and mixed.
8. Natural science (those branches of it which are not necessarily connected with any part of a naval Officer's training; *e.g.*, geology, mineralogy, metallurgy, botany, &c.).
9. Modern history.

intended to bear, Dr. Blimber made him bear to pattern, somehow or other."—"Dombey and Son," chap. xi.

[1] These personages must not be confounded with the Naval Instructors, who are Officers of the Navy, and who have really done wonders considering the difficulties in their way.

[2] See note to proposed Seamanship Course (p. 633).

10. Shipbuilding.
11. Surveying.
12. Meteorology and sea geography.[1]

The list may be made longer if wished. The intention is to make it comprehensive; to give Officers the chance of keeping up their knowledge already acquired, and of so adding to it that they may be more efficient instruments for advancing the interests of their country wherever they may be employed. Those who desire to avail themselves of the advantage of the "general" course should be allowed to make a selection from the list of subjects, and be instructed therein. Shortly, perhaps two months, after beginning there should be an obligatory examination, when all whose progress might prove to be unsatisfactory beyond hope of improvement should be dismissed from further attendance at the place of instruction. At the end of the course there should be a voluntary examination in the subjects in general, and prizes should be given to those who acquit themselves best. No Officer should be allowed to enter as a student in either division of the "higher" course until he had completed two years' actual, *bonâ fide*, unmistakable service at sea since the date of his seniority as Sub-Lieutenant.

The "special" division should be subdivided into a series of sections or "schools" after the fashion of the "honour examination" previously suggested (see p. 637).

I. Mathematics, higher navigation, and astronomy.
II. Natural science.
III. Naval architecture and steam engineering.
IV. Tactics.
V. Naval and maritime law, naval history, modern languages.
VI. Surveying, meteorology, sea geography.
VII. Hydraulic and dock engineering (and other "schools" if desired).

The length of the course should be two years. There should be a "weeding out" examination at the end of the first three months, and other examinations at intervals of, say, six months, both to ascertain what real progress was being made by the students, and, if necessary, to carry on the weeding out process. As comparatively few people wish to become specialists, the number of those attending the general course of education would be nearly sure to largely outnumber those attending the special course. Possibly in some of the schools there would not be more than two or three students at any given time. But if these were properly instructed, the Service would have the advantage of being able to look for highly trained men to enter the ranks of its surveyors, its constructors, its navigators, its marine engineers, its instructors, and its engineers of works. In every one of these callings except the last, men wearing naval uniform, and having passed years at sea, have attained great eminence, and it is hardly to be supposed,

[1] Perhaps it is hardly necessary to state that neither here nor elsewhere are the subjects placed in order of merit.

were the chance given them, that they would not achieve equal distinction in that also. The advantage to the country could not fail to be considerable, and we should very likely no longer observe those astonishing features of some of our greatest establishments, which could hardly have existed had their designers been seamen as well as engineers.

Up to the present—under the terms of the provision that no one be admitted to the higher course till after the completion of two years' *bonâ fide* sea service since the date of his seniority as Sub-Lieutenant—we have been dealing with ranks of which that grade is one. Let us pass on to those that are higher. The present examinations before establishing a right to a Sub-Lieutenant's commission are the last that all must submit to. One object of this essay is to restrict the number of examinations which are made generally compulsory, and to diminish the significance of those that must be retained. But here it is proposed to add one to the number of those examinations which all must undergo. That one is a real examination for the rank of Lieutenant. At present in theory a Sub-Lieutenant can be called upon to perform, and becomes responsible in himself for the due performance of, all the duties which are expected of a Lieutenant. The almost universal practice is not in accordance with this theory. Five Captains out of six will not entrust to a Sub-Lieutenant—examinations and even first-class certificates notwithstanding—many important duties if by any chance a Lieutenant can be got hold of to perform them. This is the real practice, and no supposed merit of an examination at the end of the period served as midshipman has in the course of our long naval history been able to alter it. It seems plain that an examination for Sub-Lieutenants before becoming Lieutenants is desirable.

Suppose it to be ruled that no Sub-Lieutenant shall present himself for this examination until he has completed twelve months' real, honest, unmistakable sea service (in these days it is, unhappily, necessary to protect the expression "sea service" with strong adjectives), but that he may do so at any time between the completion of this first year and that of the second year, of mere seniority in his rank, regardless of any further length of time served at sea, and that the examination itself is pretty nearly the same as that which he had to pass on ceasing to be a midshipman. Such a rule will have several advantages. To pass satisfactorily, the Sub-Lieutenant will have to keep up for, probably, full half of the time that he continues in that grade, and perhaps much longer, the knowledge that has hitherto been imparted to him. He will be certain that it will be no more severe trial than that which he has already undergone, and he need not fear it as a contrivance for turning him out of the Service when he has given several years up to it. A *bonâ fide* service of at least one year at sea before becoming a Lieutenant will be secured. Another advantage will be the accurate and authoritative differentiation of the responsibility of a Sub-Lieutenant and of a Lieutenant.

It follows from what has been said that this obligatory examination would be a mere "pass." There would be no great harm done were

it made an exact repetition of that undergone at the end of the midshipman's service. But it would be well to take advantage of the opportunity to add to the seamanship part of it the actual performance, under the notice of the examiners, of some real evolution, such as tacking a ship; conducting, as Officer of the watch or First Lieutenant, the operation of shifting sails or spars; or working a boat under sail and under steam. There might also be added to it a few questions, put to ascertain the candidate's knowledge of the internal economy of a ship, instruction in which is so unaccountably neglected in the British Navy.[1]

Of the entry, training, and higher education of executive Officers, nearly as much has been said as the limits of this essay permit. It is necessary to dwell on these subjects at the greatest length allowed. For there can be no hope of making our *personnel* efficient unless those who have to lead it, and be the examples to the rest, are properly prepared for the stations they will have to fill. In suggesting several of the examinations already detailed, it has not been thought necessary to specify the places at which they should be held, or at which the student should study. It has not been intended to confine these to the Royal Naval College or to any other single establishment. As regards special branches of a naval Officer's education, there is little doubt that not only must they be best taught at the Naval College, but that they are not taught anywhere else. As to most other divisions of it, it may be accepted as certain that they can be, and are much better taught elsewhere. The existence of several establishments, even of education, generates a very healthy competition. There is an admitted rivalry between the colleges of Oxford and Cambridge which has had very excellent results; and perhaps there is a beneficial emulation between the universities themselves. As all these wealthy corporations are practically independent of the contributions of students, they can have had but little desire of the meaner sort in their endeavours to attract pupils.

There is no reason why the Naval Administration should not make arrangements with any seat of learning of sufficient reputation to undertake the training, perhaps in general knowledge, but certainly in special subjects, of a portion of the Officers under its orders, provided that the cost to the country do not exceed that incurred on behalf of a student at Greenwich. That college would find itself engaged in an advantageous rivalry with others; and would, without doubt, maintain and even add to its efficiency. A natural consequence of this would be the placing of the conduct of all examinations in the hands of a body quite unconnected with the places of instruction of the candidates. The principle of this has been for some time admitted in the Naval Service, and requires no argument to support it. The British Navy—can it be said too often?—is so great a service that every tendency to narrow the spirit of those belonging to it is sure to

[1] One proof, amongst many that might be adduced of the present policy of discouraging the acquisition of a real knowledge of seamanship in the Navy, may be found in the fact that, though there are long and short "courses" in gunnery and torpedo, there are neither long nor short in seamanship.

do it harm. It is not a small separate arm or corps, but a whole Service, comprising all arms and several corps. It is of vital importance to it that there should not be a dull evenness and dead level of intelligence and acquirement among its Officers. To prevent this the best way is to impart the necessary variety, which need not by any means lead to improper divergence, to the systems on which those Officers are trained. A single school inculcates in all its scholars a special "tone," which may be good or may be bad, but which, if there are no rival establishments, can hardly by any possibility be quickly or greatly improved. A solitary place of the sort generates no *esprit de corps*. Who has ever heard a midshipman swagger on the strength of having been in the "Britannia"? But were there three or four such ships, we should have glorification and disparagement of their separate merits perhaps too often.

A boy's mind gets narrowed soon enough in any *service* in which, as distinguished from a *profession*, he is under strict regulation. Therefore do not aggravate what is bad enough already by prematurely collecting boys from many different schools, and putting them all through the same educational mill. Similarly send those who have special aptitudes which promise to be of use to the Service to the places where those aptitudes are likely to be made the most of. It is, no doubt, a horrible proposal to make, as advising something not put in practice hitherto; but perhaps the world would not come to an end if a young Officer with a talent for languages (there are some such) were sent to France, Germany, or Spain, to cultivate it. He would learn a good deal in the space of time he now idles on half-pay waiting for a ship.

If this essay ever finds a reader, is it too much to ask him to try and realize what the Service would be if the proposals as to the education of Officers here made should be carried out? Would not more time be devoted to real service at sea than is now possible? Would not a young Officer's chances of obtaining a varied experience be greatly increased? Would not the general culture of the Service be considerably raised? Would not the special talents of individuals be cultivated, and be taken advantage of? Would not the general spirit of the whole body of Officers run infinitely less risk than now of being narrowed? Would not the Navy have to depend much less than it has at present on outsiders for the performance of duties which peculiarly belong to it? Suppose all that has here been advocated were carried out, would not there be an important saving in actual money to the taxpayers?

We may now quit that portion of the subject proposed for this essay, which deals with the entry and training of executive Officers. As yet the writer has, he ventures to believe, been only supplementing the proposals of Officers of greater abilities and longer service than he can boast of. He may have suggested alterations and advocated extensions, but on the whole he thinks he has but followed in the wake of better men. It is to be hoped that this will not weaken his suggestions. "I have never yet seen," said the illustrious statesman, Edmund Burke, from whom the motto prefixed to this essay has been

taken, "I have never yet seen any plan which has not been mended by the observations of those who were much inferior in understanding to the person who took the lead in the business." Some method of checking the widening of that great gulf which separates the two great branches of the seafaring profession, the Royal Navy and the Mercantile Marine, might perhaps have been treated of in this section, but on the whole it seems better to deal with that when considering how to improve the efficiency of our Reserves.

5. *Ranks and Qualifications.*

The more ranks there are the more frequent will be the steps. It is more encouraging to get a little lift every now and then than to linger for long periods in an insignificant station, and make sudden jumps of considerable height at the end of the former. Nearly all navies have a larger number of ranks than we have. The following are proposed:—

I. Subordinate Officers—
1. Cadet. Serves one year in a sea-going training-ship; age, say 15 to 16.
2. Midshipman. Serves four years in regular sea-going men-of-war, for the last two years with a commission; age, 16 to 20.

II. Watch-keeping Officers—
3. Sub-Lieutenant. Attains rank on passing the qualifying examination, the "previous" examination in honours, or the final honours examination; age, from 20 to say 24.
4. Lieutenant. Attains rank by selection, after passing the qualifying examinations; age, 24 to say 32.

III. Superior Officers—
5. Lieutenant-Commander. Attains rank by selection, after regulated sea service; as Lieutenant, at least three years; age, 32 to say 36.
6. Commander. Attains rank by selection, after regulated sea service as Lieutenant-Commander, of at least two years; age, 36 to say 40.
7. Post-Captain (the old and honourable naval designation). Attains rank by selection, after regulated sea service of at least two years as Commander; age, about 40 to 50.

IV. Flag Officers—
8. Commodore (substantive rank). Attains rank by selection, after regulated sea service of three years as Post-Captain; age, about 50 to 55.
9. Rear-Admiral. Attains rank by selection, after regulated sea service of four years and a-half in the ranks of Post-Captain and Commodore combined.

10. Vice-Admiral. Attains rank by seniority, after regulated service (either sea or harbour) as Rear-Admiral, the qualifying period being fixed according to the state of the Rear-Admiral's list for employment.
11. Admiral. Attains rank by seniority.
12. Admiral of the Fleet. Attains the rank by selection and special nomination of the Sovereign. This exalted rank should be conferred by patent, not by commission, to enhance its dignity.

Of the cadet enough has been said when treating of entry into the Service and early training.

At the expiration of two years' sea service, on passing the regular examination, the midshipman should receive a commission, and be granted a suitable uniform.

The number of Sub-Lieutenants in any sea-going ship carrying such Officers should be based on that of the Lieutenants. In very small vessels they might take the place of the latter Officers.

Of the Lieutenant nothing need be specially said here.

The Lieutenant-Commander should succeed to the positions now in some cases held by Lieutenants and by Commanders. They should have all commands now held by Lieutenants, and should be second in command of all ships commanded by Post-Captains, except flag-ships and certain others, such as the gunnery ships, steam reserve ships, &c. In such ships as might retain a Commander as second in command, they should take the place now occupied by the First Lieutenant. They should be eligible with Lieutenants for posts on the staff of Flag Officers, and as the senior Staff Officers of gunnery ships. Those who had done duty when Lieutenants as navigators might continue to perform similar duty in larger ships.

The positions of Commander and Post-Captain, with the exception of the modification in that of the former just mentioned, might continue much as at present.

The Commodore, as an Officer with substantive rank, might command the smaller stations as now, and be placed in charge of steam reserves, dockyards, &c., and be more largely employed in command of divisions of foreign stations than has hitherto been the case. Were the last done a curious and not particularly beneficial anomaly of the Service as now regulated would disappear. By the existing practice a junior Captain is generally placed in positions of considerable dignity and much responsibility; whilst the senior Captains when at sea are rarely out of sight of a superior. A Captain, on first receiving an appointment in his rank, goes to a foreign station, and is placed in charge of a division. No superior is within hundreds, perhaps thousands of miles of him; he conducts what is often important business with governors, diplomatic and consular authorities, and foreigners; and he has usually a small squadron under his orders. A senior Captain on the other hand, when at sea, is always in a squadron under the eye of another; he cannot even use a steam-launch without permission. This is a curious inversion of positions. If age and expe-

rience be, as they are usually esteemed, the proper qualifications for positions of superintendence, youth and its concomitant energy may be held especially fit for the command of fighting ships under the immediate direction of an experienced chief. The ages of some of the men who commanded ships under Rodney, Howe, or Nelson, would look strange if printed by the side of those who command our modern ships of the line. Proper arrangements for appointment to command during the Lieutenant-Commander's and Commander's period, would enable just as good an estimate to be formed as can be formed now, of an Officer's capacity for managing a ship at sea in a squadron or fleet.

In the foregoing scheme the principle of selection has been more largely recognized than is now the rule. This has been done because of the advantages believed to be due to it. But whatever may be thought of it, it is nearly certain, nay, quite certain, that before long it will be more usually resorted to than is now the rule. No one who has observed the recent changes in the sister Service, or who discerns the temper of the times, can doubt that, whether we will or no, it will be forced upon us.

6. *Appointment and Employment.*

The first Lord Lytton said in one of his novels that the worst use to which you can put a man is to hang him. The worst use to which you can put an Officer of an active service is to put him on half-pay. Nevertheless a list of unemployed Officers, if not too large, is a priceless advantage, which, perhaps, no Service enjoys but our own. The greatest, indeed an ever-threatening check to rapid expansion, when war occurs, of all the vast forces of the military States of Europe, is the want of a sufficient number of experienced persons to officer them. This is so true, that in estimating the strength of these mighty forces, we must make an important deduction from the figures of the total, and must think, when we hear people talking glibly of "millions of armed men," that a good many thousands, nay, tens of thousands, would be unavailable, because there would not be Officers enough to lead them. Indeed, we are not without actual experience of recent date of what this would mean in the case of a Navy. In the War of Secession, the *personnel* of the United States' Navy was increased from 7,000 to over 40,000. The number of Officers on the list at the beginning of the struggle was not much more than sufficient for the former total; a certain number elected to give their allegiance to their State rather than to a fraction of the union of States, and these were lost to the Northern Navy. The greatest difficulty of the Federal Admiralty was to find suitable Officers for its fleets. The number of men afloat and actively employed at the home ports in the French Navy in 1870 was 39,000. Before Paris had fallen this number was increased to 68,000; the total force of seamen and marines (of whom the latter do not serve afloat) amounted before the war was over to 96,000. The French Navy has not, indeed, a "half-pay" list, like we have, but a comparatively large unemployed list of Officers; and a want of these to meet the great

expansion of the *personnel* of the lower ranks was not one of its most conspicuous difficulties. Neither of the wars specified were to any great extent naval contests, or an even greater expansion of the navies cited would have been necessary.

The advantages of a considerable list of unemployed Officers, therefore, in view of the inevitable expansion that our Navy would have to undergo in war or preparation for it, are obvious. The disadvantages, being daily observed, are even more obvious. The question is, How are the dimensions of such a list to be properly regulated? This question is, probably, less difficult of solution than is generally assumed. In the first place, the casualties of the Service in ordinary times of peace must be provided for. If we only keep, say, 50 ships generally in commission, it is plain that a list of 50 Captains will not be sufficient to command them. Were the number of Officers of that rank limited to the figure given, it would be impossible to provide for the regular reliefs without a batch of promotions, which would give rise to ever-recurring and very awkward complications. Any probable sudden addition which it may be necessary to make to the number of ships in commission must also be allowed for. So, too, we must keep the list of Officers in a condition to bear at least the strain of equipping a fleet at the first threat of hostilities. Were it necessary to make a large promotion whenever an ugly international complication might arise, though peace should in the end be preserved, the last state of the Navy List would be a long way worse than the first.

It may, of course, be found that the members of the different ranks settled in accordance with the above principles would give us many Officers over and above those who would be required to serve afloat. There is no reason why these should be all unemployed. There are plenty of duties, not necessarily performed afloat, the execution of which might with great advantage be entrusted to naval Officers.

As a matter of fact, this is the practice of all navies but our own; as indeed it is of our land service. What these duties are need not be specified here; several of them must occur at once to any person who has studied the condition of the Navy at large. If they can be satisfactorily performed by civilians when necessary, as our history shows that they can, the substitution of non-naval men for those belonging to the Service, when the latter might be required afloat, could—considering that we should still have a very large civilian *personnel*—be easily provided for. It should be remembered that even for a regular Army or Navy war is an exceptional state of existence. We can thus see the principles that should be taken as a guide in fixing the numbers of persons in the several ranks. These are: first, provide for the habitual requirements of the fleet in commission; second, let the numbers of each rank be such that the casualties of service and the regular reliefs can be met; third, add to the numbers necessary for both of the above as many as could be employed in the performance of essentially naval duties on shore, which would allow for the requisite expansion in cases of emergency, and the subsequent scarcely less important absorption. Were these principles followed, the only Officers really unemployed would be those just about to receive, and those who had

just quitted certain appointments; those who might be incapacitated by temporary ill health from serving; those placed on temporary half-pay for reasons of discipline; and those few who might make out a good case for leave of absence of a protracted character.

In order to ensure a proper flow of employment afloat, it can hardly be doubted that the duration of appointments should be arranged on a kind of sliding scale adjusted to meet the proportions at any time assumed by the fleet in commission. If, for instance, when three-fourths of the Officers of any rank are required to serve afloat the duration of appointments in that rank be fixed at three years, when the number required might fall to one-half, the duration might be restricted to two years. It might, for the advantage of the Service, and—what is of less importance, though still deserving of consideration—for the good of the Officers themselves, be found desirable to fix a *minimum* of time for which any appointment might last, and such *minimum* should not be diminished. That this is not difficult to bring about has been shown by the facility with which the times during which many posts can be held have been rigidly defined. Most Admirals and Captains, and the greater number of Officers belonging to stationary ships, are now relieved punctually at the expiration of three years, and might, if necessary, be relieved with almost as much, if not with quite as much ease, at the end of five years, four years, or two years.

It should never be forgotten that there is great extravagance in paying one man to do nothing, and another man to do what the former could perform perfectly well. Yet this is exactly what is brought about by the coexistence of a large half-pay list, and of a full civilian Staff during peace time. It is an evident anomaly that the only section of the whole Naval Service, in its evident sense, that is continually kept up to practically its full war strength, in peace is the administrative portion. But perhaps no anomaly will appear surprising in a navy in which marines are invariably sent to sea, whilst considerable numbers of seamen are learning to be unseamanlike in harbour ships.

Another anomaly that all must have observed is, the practice of keeping the juniors of each rank unemployed. The juniors, from the very fact of their being the juniors, are just the persons who should not be left idle. It would be greatly to the benefit of the Service were each Officer, immediately on promotion or very shortly after it, appointed to the post suitable to his new rank. Such an Officer is in the full swing of duty; if he be worthy of his promotion, the chances are many that when the time for it approaches, he will occupy his mind in pondering on the methods that he would adopt were he advanced to the grade above. Put him when so advanced on an unemployed list for a long period, when he will, perhaps, be removed from every naval influence, possibly even from a sight of the sea, and, in addition to remaining ignorant—as the unemployed under any system of appointment must, it may be admitted, usually remain—of the changes that are being made in the Service, the chances are again many that, his thoughts being turned in a very different direction, he

will forget much. Early appointment after promotion could certainly be achieved with as little difficulty as appointment after (as is at present the general rule) a considerable time out of employment. It is only necessary to look at any one of the lists to see that there would be no more insuperable difficulty in making the unemployed period occur after, perhaps, the completion of the second or third year of seniority, than immediately after attaining the rank. Most appointments, especially as they become more and more dependent upon position on a kind of roster for service—which is the modern rule—are hardly connected with patronage. The establishment of a Board of Appointment would be very likely to introduce order into what at present is somewhat chaotic, and need not in the least interfere with the powers of exalted officials to select, as they often do now, to the manifest benefit of the country, those Officers who, in their opinion, are best suited for particular posts.

Though not immediately connected with the question of employment, the mode of making promotions still bears on it. It is not intended, just now, to discuss the existing method of selecting Officers for advancement; all that need be looked at in this place is the, so to speak, mechanical operation of promotion.. The custom is to allow vacancies to accumulate, and then promote Officers in a batch. No one has, as far as is known, ever attempted to defend this practice. The objections to it—the hardships, the injustice that it entails—are patent to all. In addition to these, and this more concerns us at the moment, it seriously complicates the employment question. If an Officer whose promotion is as good as certain be kept in the lower rank for several months, merely that time may be given for further vacancies to occur in the higher, it will be impossible to arrange the duration of such appointments as he may hold upon any distinct principle. Promotions should follow immediately upon vacancies; the only interval between the two should be that which might be indispensable for verifying the latter.

The duration of appointments is to a great extent governed by the length of time that ships are kept in commission. This latter has been nominally three years for at least half a century, probably for very much longer. It is singular that this number of years should be adhered to even after a most important revolution—for revolution it really was—has been made in the system of commissioning ships. It is not now thought necessary to bring a ship home to be paid off; and, as a matter of fact, many ships are paid off and re-commissioned abroad, their Officers and ships' companies being sent out and back in transports and other vessels. Now it is worth considering if a rigid adherence to a period of time, adopted under circumstances altogether differing from the present, be prudent. Are not a ship and her machinery frequently—or indeed generally—in a far from effective condition at the end of the seven years which commonly comprise two commissions of which one has been begun abroad? Does not the process of deterioration of the *matériel* go on at an accelerated rate after the end of, probably, the fifth year's service, for which period most ships and their equipment have been shown by experience to

remain effective? Would not two commissions of two and a half years each be more likely to ensure the maintenance of efficiency throughout the service of the ship until her return to England for more extensive overhaul and repairs than could be accomplished at a Colonial dockyard? Careful weighing of these considerations will, not improbably, result in showing that the length of ships' commissions may be adjusted according to a sliding scale based on the total number required to be kept in commission at any one time. A ship to be re-commissioned abroad should be paid off for the first time at the end of two years and a half. When this might prove inconveniently short, because of some temporary or protracted increase in the number of ships, the commission period could be extended to three years, three years and a half, or any required length of time. It is plain that some such system would simplify the business of appointing Officers and of putting a stop to long periods of unbroken idleness on the unemployed list. For, even if it be impossible to reduce the total time during which Officers remain on shore in any one rank, it cannot be difficult to prevent their being practically out of the Service for so many continuous months, or even years, as they are now.

Having once decided what the duration of any particular appointment should be, its vacation at the end of that time should be inflexibly insisted on. It is one of the advantages of our Service that its public opinion has almost invariably been in favour of keeping up a constant connection between that portion of it which is afloat and that which is ashore. This public opinion of the Service has been occasionally ignored or disregarded, but in the end it has made itself felt. Were it becoming, the good effect of this might be emphasized by contrasting what happens in the Navy in this respect with what too often takes place in other services. The recognized defenders of the plan of renewing the appointments of those who hold particular posts are the incumbents of such posts themselves. Do they, it may be asked, ever assert that those, whom they declare it would be unwise to remove to the unemployed list when their appointments expire, are never permitted to vacate such appointments "to better themselves?" If there be no harm in removing a man from a post, with the duties of which he has become thoroughly conversant, in order to give him a lift upwards, there surely cannot be any harm in relieving him at the regular completion of his term of service.

7. *Pay.*

The pay of Officers cannot be properly discussed in suitable detail in an essay like the present. Nevertheless, some observations should be made upon it. The system of paying Officers now in force is open to serious objection in several points, as also is that of the paying the men. The existing plan acts as a distinct discouragement to foreign service. Except as regards a trifling difference in the amount of the command money, the home and foreign, the harbour and sea pay of all Officers and men are the same. If the pay given to an Officer in Portsmouth Harbour or Hamoaze, and to a foremast hand too for the

matter of that, is on a proper and equitable scale, that which is given to those at sea or on foreign stations is manifestly inadequate. If the latter is correct, then the former is unduly high.

It is well known that on many foreign stations, probably on nearly all, the price of wholesome food such as an Englishman finds necessary, is considerably higher than it is in England. The difference of climate also renders necessary or at least prudent the accumulation of certain comforts about the person which can be well dispensed with at home. All who have served much abroad will know that on several stations on which white clothing has to be much worn—however absurd it may seem to those who have not had such experience—the washing bill is a formidable item in what has to be a slender budget. If an Officer have only ordinary prudence and insures his life he will find that proceeding to what are not considered specially unhealthy stations often leads to a large increase in the premium that has to be paid yearly. In fact, if any Officer leave a harbour ship for one on a foreign station, he will discover that his pay goes less far as to his necessary expenses than it did at home.

It has been a principle of recent naval legislation that sea service should be encouraged. Few things would encourage it more, both on the quarter-deck and on the lower-deck, than a suitable scale of pay. The present term "half-pay" for Officers on the active list might be abolished. An Officer might then receive "pay"—perhaps increasing as at present according to length of service—and the following additional allowances: harbour pay, sea pay, foreign service pay. The harbour pay should be given to all those in stationary ships; the sea pay to those in the Channel Squadron in sea-going ships employed on the home coasts, and in the First Reserve ships when actually at sea or absent from their particular port; the foreign service pay should be given to all serving in sea-going ships abroad. Harbour ships abroad should be treated as constituting special cases, and special rates of pay should be drawn up for such as serve in them. Command, First Lieutenants, instructors' pay, &c., should be classed as "allowances," over and above any of the before-mentioned kinds of pay. Officers doing duty on shore would probably be in receipt of special rates of pay; where they might not be, they should receive harbour pay *plus* the regular allowances. This will show the lines on which any scheme of adjustment of the present system of paying might proceed.

There are not wanting signs that some of the taxpayers—at all events—are growing a little restive under the heavy burden of the "non-effective" portion of our naval expenditure. This restiveness is more likely to increase than to grow less. Perhaps the first thing that will have to go will be the widows' pensions, and they will probably carry with them the compassionate allowances to children. Indeed, it is not easy to see on what principle these can be defended. They, in effect, consist in the presentation to those who marry and have families of what, were its prospective value capitalized, would amount to a far from inconsiderable sum. Those who do not marry and who may be presumptively credited with prudence and self-restraint as a body, do not receive this advantage. There is consequently a distinct and

palpable reward offered to those who marry and who, at best, cannot collectively equal in prudence and self-denial those who do not.

Of course it would be a gross injustice to deprive any who had entered the Service on the faith of promises that this reward would be within their reach of their chances of obtaining it. But different arrangements may be equitably made with new comers. It might be enacted that no one entering the Navy in any rank—for this concerns the men as well as the Officers—after a certain date would be entitled to the promise of a pension for his widow or his children unless he himself should contribute thereto during his lifetime. This contribution might be made compulsory, and ultimate enjoyment of it by either the contributor or his family could easily be assured. A saving would very likely result were a moderate addition made to the whole pay of the Service to meet this compulsory contribution, for the charges due to the pensions in question would in the end be altogether absorbed. There should be a *minimum* rate of contribution fixed, and permission should be given to exceed this in cases where individuals in order to increase the subsequent pension desired to do so, provided a certain *maximum* were not passed. The widow and children of the contributor would become entitled to pensions varying with the rank or length of service (which latter would imply length of time during which contributions had been paid, and, consequently, their amount) at the time of his decease. If he did not marry, or if his wife should predecease him, he might receive a lump sum on retirement or at a fixed age, or an addition to his own pension, or the power of bequeathing by will a sum varying with the number of his contributions.

But if a premium be held out to improvidence, it is not less true that providence is in reality discouraged. A person, who now insures his life, if called away by his duty to unhealthy climates, has to pay out of his own pocket the increased charge for his insurance. It is by the act of the Government and for the good of the country, that he goes where an additional payment becomes necessary; and it is the reverse of just to tax him for so doing merely because he has shown the virtue of providence. The extra amount due on a policy of insurance, the Government, of course, fixing the *maximum* amount of such policy, should be paid for, and not by the insurer. The same reasoning applies to the increased rate levied by insurance offices on war risks.

8. *Retirement.*

The objects of retiring pensions are several. One is to make some provision for those who are no longer able to serve; another is to hold out an inducement to Officers to quit the active service that the lists may be cleared, and a flow of promotion be maintained. If the first were the only object it would not be necessary to do more than give such pensions as would fairly reward those receiving them for the length of time they had spent in the Service. The second object necessitates the fixing of the amount at a figure which shall be sufficient to induce Officers to accept it. There can be no very strong reason for clearing lists from which there is practically no promotion.

There may be an apparent logical soundness in allowing no one to be included in a list of Flag Officers unless his age be within the limit supposed to bound the capability of serving actively. But the soundness is, probably, more apparent than real. There is no especial virtue in any particular limit of age. Every one's experience will supply him with plenty of instances in which, of certain pairs of men, he who is sixty is less active and capable of mental or bodily exertion than he who is sixty-five. The best that can be said of any rigidly fixed age test is that there is due to it a chance of getting rid of the worn out and inefficient, and of retaining only the active and truly efficient. But, after all, it is only a chance. There can be no doubt that it does deprive the country of the services of many men who are in every way fitted to do excellent work, but in favour of whom it would, under existing rules, be extremely difficult to make exceptions.

It might be well to abolish all compulsory retirements from the several lists of Flag Officers. A certain number of Officers would in that case no doubt remain on the so-called "active" list, who could not be depended upon for any arduous service. But there would be no necessity to employ them on such duty. It would be impossible to give every person on such a list a command; and, as selection would have to be made, it would not be necessary to give one to any one who was held to be unfit for it. The field of selection would be considerably enlarged. The expense would also be reduced. It often happens now that the name of a Flag Officer is removed, sorely against his will, to another part of the Navy List, and that he is compensated with additional pay, which he would gladly forego were his name allowed to remain where it was. There would, probably, have been no chance of his ever being actively employed even had he remained on the "active" list. But, simply to keep up the appearance of logical consistency, he is aggrieved, and the taxpayer heavily fined. This is not the whole of the evil; excellent and thoroughly efficient Officers are treated in the same way that it may not look as though some were unduly favoured by rules being relaxed in their case.

Voluntary retirement from the Flag List should, of course, be provided for; but the scale of pensions might be revised in the interests of those who have to find the money. In those lower ranks through which the stream of promotion is supposed to flow in its full strength compulsory retirement might be retained as an admittedly necessary evil; and voluntary retirement should be encouraged by fixing pensions granted for it at a higher rate. The authorities, of course, would retain the right to refuse permission to retire whenever it seemed to them good to do so.

In all retirement schemes there is one class of Officers whose interests have been but little thought of. That class consists of those who do not retire. They go on serving, many of them at what is practically a considerable pecuniary loss, as they would have got more available money by retirement, presumably because their services cannot be dispensed with. Any wholesale distribution of even titular rank amongst Officers who retire is an indirect injury to those who remain. There are many cases of Lieutenants still on the list in that grade

who have continued to serve on 10*s.* a-day, whilst their juniors have been retired on as much or more, and have been made Commanders into the bargain. The position of Officers who have been granted a step on retirement would be a very difficult one if—as actually occurred in France only ten years ago—it were necessary for the country to again avail itself of their services. Let a step in rank be given by all means; but, in justice to those who continue to bear the heat and burden of the day, let it not be given too freely. Some such regulation as that at present in force with regard to the bestowal of the rank of Rear-Admiral (Retired) might be made applicable to all grades.

B. Civil Branches.

It will not be necessary to discuss the question of the Officers of the Civil Branches with the same fulness as that of the Officers of the Military Branch. To do so would merely lead to repetition. The general principles already laid down may be understood as being intended to guide us in securing the efficiency of all classes.

a. *Medical Officers.*

Is there any convincing reason why a qualified medical man should be called upon to undergo an additional examination before being admitted to Her Majesty's Service? Are not the examinations to which those who obtain the degrees and diplomas of more than one distinguished University or similar body have to submit, sufficient to ensure adequately instructed medical Officers? As many corporations, either educational or simply examining, are legally empowered to grant the certificates necessary to enrolment in the medical profession, it is, of course, possible that of some the formal qualification may prove insufficient. It might perhaps be practical to make a rule that the degrees or diplomas of certain specified bodies would be accepted as entitling the holders of them to become medical Officers of the Navy. Gentlemen coming provided with certificates from other sources might be made to undergo a special examination.

It is not intended to convey that the present system of selecting candidates for the Service has not worked well. To obtain a highly competent body of medical Officers for the Navy is of immense importance; and this has been completely attained. The great object is to remove unnecessary restrictions upon the number of those who desire to join the Navy; and it may fairly be supposed that having to pass an extra examination is hardly looked upon as an encouragement to come into it.

The following proposed method of selecting candidates for the medical branch of the Service is brought forward for consideration:—Let certain great medical schools be specified as entitled to confer the necessary qualification for a surgeon's commission. Scholarships might be founded at these schools for students intending to serve in the Navy, if necessary, under securities for the return of the amount paid, should the intention not be carried out. The choice of the

persons to whom the commissions should be given might be left to the authorities of the schools, whose reputation would be amply sufficient to ensure the selection of the proper people. Physical and moral soundness could be testified to by the same authorities. It is perhaps not being too sanguine if the belief be expressed, that gaining a naval scholarship and being specially chosen by the authorities of a great educational establishment as a fitting candidate for the public service would confer a distinction which many promising students would be glad to attain to.

The recent foundation of a Naval Medical School at Haslar will probably bear excellent fruit. The medical service of the Navy is quite large enough and important enough to stand alone. It is beneath the dignity of our Navy—the greatest in the world—and opposed to its efficiency that it should, in any particular whatever, hang on to the skirts of another Service. A limited course of instruction in the special work required of a naval surgeon is pretty sure to be of great use to those young medical Officers who, on first receiving their commissions, can have little experience of a sea life and those who live it. Prizes of the kind now given at Greenwich might with advantage be given to those who distinguish themselves at Haslar. Should the *curriculum* at the former establishment ever be extended on the lines suggested in the earlier part of this essay, every opportunity should be given to medical Officers, desirous of extending their general culture, of taking advantage of it. It would be but in accordance with the previous history of their illustrious profession if some of them eventually were found the most worthy of occupying, at the great Naval College, the most important scientific chairs.

It might be beneficial to the Service to give to all medical Officers, after a moderate length of service, the right to leave it with either a pension of limited amount, or a sum of money in a single payment. Many a young student would perhaps gladly avail himself of the opportunity of studying nature in many different parts of the world, which a few years spent in the Navy would give him; whilst he might have a reasonable repugnance to the prospect of remaining at sea till overtaken by old age. There are many reasons why it would be well to encourage naval medical Officers to take advantage of every opportunity of engaging in private practice. It would extend their knowledge and enlarge their experience. There is not much chance of private practice becoming so extensive as to interfere with duty. Any risk of this would be effectually guarded against by the laudable public opinion of the medical Officers as a body.

The question of pay is a difficult one, and it cannot be settled in a paragraph. However well the junior medical Officers may be paid—and on that subject they probably have views of their own—it cannot well be proved that the remuneration of those in the higher ranks is relatively equally good. If a medical Officer in the Navy succeeds in reaching the more exalted position of his branch of the Service, it is only fair to credit him with the possession of qualities that would have given him a good chance of success in the practice of his profession on shore. His income then should be compared, not with

those of other Officers, but with those of his contemporaries in civil life. Whatever may be said of the equalization of the pay of the medical branches of the Army and Navy, it will be difficult to persuade those belonging to the latter that such equality exists in reality. They spend about one-eighth of their time (in all but the lowest rank) on half-pay. The fleet surgeon of a ship in the East Indies, obliged to keep up a home for his family in England, will hardly admit that his 500*l.* a year is quite equal to the 1,000*l.* a year of the senior medical Officer of equivalent rank in a regiment in India, the latter having but a single establishment to maintain and enjoying numerous opportunities of private practice.

It would probably be well also to extend the administrative duties of the higher ranks. The senior medical Officer of a large fleet might be given the temporary rank of Deputy Inspector-General, and might really perform the duties implied in that designation. Even without such temporary rank, the fleet surgeon of the flag-ship might frequently with advantage accompany the Admiral in the inspection of the ships under his command.

b. *Engineers.*

The object of the latest system of recruiting the ranks of the engineer branch of the Navy appears to form a corps of Officers of high intelligence and good education, and to discourage practical mechanical knowledge. This may be a good thing, but it should be noted that it is a distinct reversal of our long unvarying naval policy with respect to other branches. The existence, side by side, of two distinct bodies of highly educated theoretical engineers and of practical engine-room artificers reproduces with some exactness, or at the least tends to reproduce, the state of affairs familiar to readers of Macaulay. Two hundred years ago the Officers of the Navy were divided into "fine gentlemen" and "tarpaulins." The former were well educated; indeed, some of them were excellent representatives of the highest culture of the time; they made in some cases admirable Captains when any fighting was to be done, and many of them—though not practical seamen—introduced important improvements into the Service. But for many generations until the present no effort has been spared to make all our Officers real sailors. It is historically true that, as a rule, they have been so. Only recently arrangements have been made for the final absorption of the navigating branch. During half a century no Officer has been allowed a commission without having performed the practical manual work of gunnery. This applies with even more force to the case of Gunnery and Torpedo Officers. Seamanship instruction, when given, is of an essentially practical kind.

The new method of obtaining Engineer Officers for the Navy has been too short a time in existence to permit any one to form an exact estimate of its value. It has, however, the undoubted defect of allowing only one gateway into the Service. The numbers of the Naval Engineer Department are large enough to render more than one mode of access to it advisable. The Government might enter into an

arrangement with those great establishments, and there are now many, at which marine engineers are trained for the selection of promising students for the Naval Service. Scholarships might be founded as an encouragement to the more able; and suitable examinations, testimonials to physical soundness, and good conduct, could easily be provided for.

It is worth considering if regulations might not be made under the terms of which persons might enter the Navy as engineers, on the express condition of being allowed to quit it with a gratuity or small pension after a limited period of service. There would probably be great advantage in permitting, indeed, in distinctly encouraging engineers to serve occasionally in steamers belonging to our great companies. They would add by doing so largely to their experience and practical knowledge. It is well known that in large ships of war the opportunities of seeing the engines actually at work enjoyed by an engineer are not many, and those of seeing them working at their highest speed, very few.

II. Petty Officers, Seamen, and Marines.

1. *Training.*

The excellence of our present system of training boys for the Navy is admitted by all. It is copied by every maritime force of importance. It has, however, its weak points, and is not incapable of improvement. It narrows the recruiting field. At the present time it is pretty nearly impossible for any one to serve the country as a blue-jacket unless he has gone through the regular course of instruction in a training-ship. The existing conditions of naval service render a rather elaborate training more generally necessary than was the case formerly. Still, the Navy would gain rather than lose were it possible to enlist in it some of those who, in spite of an innate capacity for a sea life, are now excluded from its ranks. Training-ships were established before education had become so general as it has been made by recent legislation. There was, therefore, a reason for including in the course of instruction a good deal of mere school work. It is doubtful if this reason holds good any longer.

It is likely that inquiry would satisfy us that we may considerably reduce the school work in the training-ships, and, as a result, may find ourselves in a position to shorten the period of training in the stationary ship to one-half. Could this be done, the course might consist of six months in the stationary training-ship, and six months in the brig attached to her. This might render an increase in the number of brigs necessary, which would in itself be an excellent thing.

Lads of some nautical experience might perhaps be admitted direct into the brigs without going through the preliminary course. Something of this sort was actually tried, and was abolished as having proved unsatisfactory. It can hardly be disputed that, at first at least, the partially trained boys did not compare favourably with the fully trained. But it is not improbable that this difference would have dis-

appeared at a later period of service; and natural seaman-like aptitude should compensate for some defects of education. Provided but a moderate percentage of boys be entered direct as suggested, at the worst efficiency would be but slightly impaired, and the ability of the Navy to admit of expansion when needful would be improved.

However good may be the instruction imparted to our young sailor lads, its advantages must be to a great extent neutralized by the system of sending them to spend long periods in harbour guard-ships. In some instances, perhaps in very many, a boy or young ordinary seaman is longer in the "Duke of Wellington" or the "Royal Adelaide" than in either the brig or even the training-ship. He must forget much of what he has been taught; he cannot fail to be impressed at the outset of his real service with the harbour-ship ideas, and to contract harbour-ship habits which are not those of sea-going ships. Suppose that a boy, after a few weeks on board a brig, is sent, when rated "ordinary seaman," to a guard-ship—is kept there for seven or eight months—is drafted thence to a craft of the "Thunderer" class, and, after a three and a half years' commission in the latter, joins the "Excellent" or "Cambridge" to qualify as a seaman gunner, how is it possible that anyone with such a history can be a real sailor or anything like it? Yet an appreciable number of men in the Service have had just such a career.

The guard-ship question[1] is urgently in need of examination. Is it really necessary that crowds of youngsters should spend months in such ships? Could not a regulation be made that no man of less than ten years' service—*whatever his rating*—be allowed to serve a day in a guard-ship after the expiration of his leave on being paid off, and a short period of gunnery instruction, to which allusion will be made directly? Would it not be in reality cheaper to keep at each port two or three small rigged craft in commission to which young hands, at all events, might be sent till wanted to go abroad? Such small vessels might make cruizes of three weeks or a month at a time. Suppose, for instance, the "Miranda" were to come home to be paid off, could not she be kept six months before being dismantled in order to receive the lads now forgetting their little knowledge of seamanship in the guard-ships? and might not all corvettes and sloops be put to the same use?

One valuable item of training—the fitting out of ships has been abolished by the very efficiency of our steam reserves. Few men, and very few Officers either, have any practical acquaintance with the methods of rigging a ship and fitting her for sea: whilst of the

[1] The inordinate length of commissions, not uncommonly exceeding four years, is one cause of the undue retention of men in guard-ships. The circulation is not rapid enough. The extravagant costliness of the long commission system will be discerned some day, and then it will be discontinued. Men having only two or three years to serve cannot now be sent to ships going to distant stations, because their time would be up before the ship could come home; so they are paid to do nothing in a guard-ship but forget their seamanship, and inexperienced hands have to be rated petty officers—over and above the required wants of the Service—to fill their places at sea.

infinity of little expedients and devices which allowed play to the ingenuity of Officers and captains of tops, and gave to different ships in commission a laudable speciality, the knowledge is rapidly becoming lost. At least four ships a year at each port should be fitted *ab initio* by their own crews. These four ships should be representatives of all classes of rigged craft from the "Minotaur" to the "Mallard;" and time should be allowed to their people to bring them up to the level of ships so beautifully turned out as they are now by the steam reserves.

The elaborate nature of our training system—indeed its very perfection—throws doubt on the wisdom of keeping up our gunnery ships on their present footing. They are, of course, as necessary as ever, or indeed more so than ever, for the instruction of Officers and gunnery instructors. In practice we act as though the boys' training-ships had sufficiently trained our blue-jackets in seamanship. All deliberate instruction in that ends with the attainment of the A.B.'s rating. The frequent changes in gunnery and other drills are or may be fairly well provided for by the instruction given in the sea-going ships. It is suggested, therefore, that seamen gunners as a distinct body be done away with; that all blue-jackets on return home be sent to a receiving ship in which a course of gunnery training, not too protracted, be made compulsory; and that the gunnery schools be limited to the training of Officers and of gunnery instructors, and to the preparation of schemes of drill. The pay now given to seamen gunners could be distributed among the whole number of trained seamen.

2. *Petty Officers.*

It may be questioned if the position of our petty officers is satisfactory. They can hardly be said to have the same command over their inferiors as the non-commissioned officers of marines. Yet the former are longer and more elaborately trained, and are brought up under at least as strict a discipline. Apparently the system is in fault. It is not likely that so long as the discipline of the lower deck is chiefly in the hands of a special body of ship's police, the petty officers will assert their authority as they should. The position of ship's corporal might be abolished as a separate *grade*, and be retained as an *office*. A master-at-arms will always be required to do the necessary clerical work and supervise. But the whole body of petty officers in a ship might perform the other police and disciplinary duties in rotation, a small addition being made to their number in any given complement to prevent vacancies in important posts.

3. *Non-Combatants.*

The proportion of non-combatants in any ship's company is now excessive, and tends to increase rather than diminish. Many separate ratings might be turned into temporary offices to be filled by men selected for fixed periods amongst the blue-jackets. We may hope to see bands done away with, except in Admirals' flag-ships.

4. *Marines.*

The value of the Royal Marines as an excellent reserve is immense. But the practice of sending marines to sea—in rigged cruizers—and keeping ordinary seamen in harbour is absolutely indefensible. It is—for strong language here demands no excuse—intolerably mischievous, and should be instantly abolished. There is not a single compensating advantage, however small. The number embarked in most unarmoured ships is too inconsiderable, and the ships, as a rule, are too scattered to permit the splendid training and discipline of this true *corps d'élite* to have their full value. Supposing it to be necessary to keep about the present proportion of marines afloat, the detachments of harbour-ships and armour-clads might be increased 10 per cent., and those of cruizers (which would not include gun-vessels and gunboats) be diminished to one-third of their present strength.

It is doubtful if keeping marines afloat at all serves any useful purpose in these days. The proper employment of the corps, which all must admit is simply unequalled by any other body of soldiers, is unquestionably that which obtains in France, viz., to garrison the naval ports and the strategic *insular* Colonies. When the Navy is restored to its proper position, the position from which it has—much to the detriment of the Empire—been of late years most unwisely and unfairly cast down, Portsmouth, Devonport, Chatham, Malta, Bermuda, St. Helena, the Falkland Islands, Hong Kong, and some island port in the Fijis, will be solely garrisoned by marines, and be under the undivided command of naval Officers or Officers of the corps. The practice of keeping marines at sea and blue-jackets in harbour above alluded to is not more ridiculous than that of manning the sea forts at Spithead or in Plymouth Sound with soldiers who will have to sleep in hammocks and live exactly the life of the crew of a ship at anchor. At Bombay the turret-ships are manned by land artillerymen! A large force of marines in barracks accustomed to serve in ironclads and harbour-ships would no doubt in times of emergency enable many blue-jackets, in both classes of craft, to be set free for service in cruizers. The Germans wisely employ their marines afloat only in the two classes mentioned.

In concluding this part of the essay, it may be urgently pressed that inducements to seamen to remain in harbour, of which so many now exist, should be immediately abolished; and, on the other hand, that real inducements—of which now there are practically none—to them to serve at sea should be offered them—any additions likely to be made to the pay of the blue-jackets should be given to those coming in *bonâ fide* sea-going ships only.

III. Reserves.

1. *General Duties of the Reserves.*

The real question that the Naval Administrator has to solve is that of the Reserves. The cardinal principles of naval policy should be

to keep the Navy as small as possible during peace, provided it be capable of the utmost expansion in time of need. To ensure this, the Reserve should be sufficiently strong, well trained, and suitably organized. The statistics of our mercantile marine show us that we have plenty of seamen, that is, men who do not require any training as sailors, on whom to fall back, when an extreme expansion of the Fleet may be necessary. No other country is so fortunate. It is our own fault if we do not take advantage of this. Of late years the general history of the Navy has been apparently based on the belief that we require no help from the merchant service, even in war time. This is most deplorable. It cannot be urged too strongly that, though a sea-faring man has not been trained in the "Impregnable" or the "St. Vincent," or some other training-ship, he may still be an excellent sailor. We have a considerable Naval Reserve; but it is to be doubted if two naval Officers out of every three have ever seen anything of it. Probably not one Officer in a hundred could tell offhand how it is composed. How many men in it are abroad at any given time? How many stokers are on its list?

Our Reserves are the Coast Guard, the Pensioners up to a certain age, the Naval Reserve, and Naval Artillery Volunteers. The Coast Guard, absolutely the finest and best-trained body of men-of-war's men yet known, would supply petty officers for the cruizing fleet when expanded by the embodiment of the regular Naval Reserve, of which the great majority is composed of first-rate seamen, all of whom have had a fair, and probably sufficient amount of gunnery training. The Pensioners could take over the whole of the duties performed by the crews of the guard-ships, and of the yachts and harbour small craft, by the instructors in the drill-ships and training-ships, and by many of the Coast Guardsmen. The Artillery Volunteers could perform most of the duties now allotted to the Coast Guard in general; and could do so, if this useful auxiliary body were only increased to a proper strength, without being withdrawn from their own localities. These Volunteers might also, under the supervision of their own instructors and Officers, and the Officers and certain petty officers of the Coast Guard or of the Pensioners—who might be specially appointed for the purpose—take over the whole torpedo defence of our ports and rivers, which can only be properly conducted by the Navy and its auxiliaries. Other details of harbour defence might be left to the Volunteers; the principles to be observed being, that in war the Coast Guardsmen, seamen of the Fleet, and the Naval Reserve are to be told off—almost without exception—to man sea-going ships; that Pensioners take over all harbour duties; and that the Volunteers so assist in the performance of general duties, that they may free the regular seamen and the Naval Reserve for service on the high seas.

2. *Organization of the Reserves for Duty.*

It is not only seamen of whom we require a reserve. We want one of stokers and artificers as well. Consequently we should require also Engineers to officer the reserve stokers, or at least to aid those of the

Royal Navy to do so. The Reserve, therefore, might be divided into three classes :—

I. Seamen,
II. Engine-room artificers and stokers,
III. Artificers (shipwrights, caulkers, blacksmiths, armourers, sailmakers, &c.).

All the above should be invited to enrol themselves in the Naval Reserve. It may be assumed that we should require about 3,000 stokers, and probably 2,700 artificers of the various trades to form an adequate reserve for those branches of the Service. The engine-room artificers and stokers might, instead of doing 28 days' gun-drill, do actual engine-room and stokers' work in the steam reserve or the small harbour steamers for the same period in each year. The artificers of the various trades might in like manner work for the same number of days at their regular employment also under the steam reserve. The excellent plan of admitting stokers to the Coast Guard enables us, to some extent, to count upon certain leading stokers as experienced petty officers if the reserve stokers be ever called out. Possibly the same plan might be organized for the other trades.

It would, probably, be impossible to lay down beforehand the exact post that every Coast Guardsman sent afloat or every Reserve man called out on the approach of war, should occupy. We hardly know the number of ships that we should require to man; and consequently could not tell how many men and what ratings would be needed. We do know, however, that nearly every Coast Guardsman and every blue-jacket, stoker, and artificer, now serving in a harbour-ship would be wanted to go to sea or to stand by to go. Consequently, the men necessary to take the places of these should be told off. Every rating to be vacated by the transfer of men from the guard-ships, the gunnery ships, or the steam reserve ships to the sea-going fleet should have against it the name of the pensioner who would be called upon to fill it. A naval Officer, a Commander or Lieutenant, might be appointed at each seaport for the express purpose of keeping the pension reserve in a position to at once relieve the men in the harbour-ships when called upon. The lists containing the names of men to fill vacancies should comprise supplementary lists of pensioners to allow for casualties.

In a similar manner, if—as is to be hoped will soon be the case—the aquatic defence of the harbours and coasts by torpedoes be undertaken by the Royal Navy, that part which would be provided for by the Coast Guard, which would be very considerable, would be taken over by a certain proportion of the Naval Volunteers. For this purpose the Volunteers could be organized locally by boats' crews, or as most convenient, and be practised in the work of laying down torpedoes and manœuvring torpedo-boats. Their local knowledge would be of immense value. The whole *mobile* defence of our great commercial ports might be suitably entrusted to the Volunteers, supervised by a certain number of Officers of the regular Service, and supplemented by pensioned instructors, petty officers, and engine-room artificers and

stokers of the Naval Reserve. They could thus easily man gunboats of the "Comet" class in addition to the fast torpedo-boats. They would merely require to be drilled to work guns, and to be able to steer, heave the lead, and pull an oar. They should comprise amongst their Officers a certain number of Engineers, who might superintend the Reserve E.R. artificers and stokers in working the gunboats' engines, or those of torpedo-boats.

3. *Officers of the Reserves.*

It is not easy to face the problem of providing Officers for our Reserves without seeing cause to lament the wide and ever-increasing gulf that of late years has been fixed between the Navy and the merchant service. There is now absolutely no interchange of Officers and scarcely any interchange of men between them. Regarded from the point of view of those who desire to advance the efficiency of the Navy, this is little short of calamitous. The Navy will never be what it ought to be until it can avail itself of the wealth of ability and experience of the mercantile marine. In these days there is not even a social reason, miserable a one as that must always be, for this wide separation of two branches of the great profession of the sea. The quarter-decks of merchant ships are filled with men as well-born and as well-bred as are to be found in any service. Any Navy might be proud to count as auxiliaries the splendid seamen who command many of our great ocean steamers. The history of some of the great Transatlantic lines shows a record of good seamanship, which not only has never been surpassed, but which, as a whole, has never been equalled at any epoch. But all this at present is of absolutely no advantage to the Navy.

The plan of nominating midshipmen to the Naval Reserve indicates how we can devise a system of officering that force which may also tend to draw the Royal and the merchant services closer. Let a regulation be made that midshipmen of the Naval Reserve may, after having served six years at sea, be received on board ships of the Royal Navy either for unbroken periods of six months or for two periods of three months each, and that—at any time convenient after the expiration of such period or periods—they may present themselves for examination in the following subjects:—

I. Naval routine and duties.
II. Gunnery and drills.
III. Seamanship.
IV. Navigation and nautical astronomy.

These examinations should be divided into a "pass" and an "honours" division; and the former should be made as elementary as the demands of the Service would permit. The "honours" examination might be encouraged by the distribution of prizes. Midshipmen passing the above examinations should receive commissions in the Naval Reserve as Sub-Lieutenants; and no person's name should be allowed to remain on the list of midshipmen more than nine years. If any reserve midshipman had not become a Sub-Lieutenant in that

time his name should be removed, and his further services be dispensed with.

After two years' service at sea as Sub-Lieutenant, young Officers of the Reserve should serve again for six months on board one of Her Majesty's ships, and at the end thereof undergo an examination in the same matters as before, simply to see if they had kept up their knowledge of them. All who had passed this examination should, on the completion of five years' seniority as Sub-Lieutenants, be eligible for promotion by selection to the rank of Lieutenant.

The rank of Lieutenant-Commander might be introduced into the Reserve with advantage. Any Naval Reserve Lieutenant who should, after having attained a seniority of five years in that rank, serve on board one of Her Majesty's ships for an aggregate period of not less than nine months might, after having been ten years a Lieutenant, be eligible for promotion by selection to the rank of Lieutenant-Commander.

Regulations of a similar character should be drawn up to encourage Engineers of the Naval Reserve to pass limited periods of time in the regular Navy and learn the mode of conducting duties in that Service.

It would be of immense advantage to the Service if there were a medical branch of the Naval Reserve.

It is not easy to understand why there is not a considerable body of Reserve Medical Officers. They might do twenty-eight days' duty at a hospital or on board one of the First Reserve or harbour-ships annually, to correspond with the performance of drill duties by the Lieutenants, &c, of the force; and rules similar to those already specified might be made to regulate their promotion to the rank of Staff Surgeon.

With regard to the Naval Volunteers, it may be said that they would do well to call themselves simply "Royal Naval Volunteers;" and that no man should be considered an "efficient" who could not steer a gunboat, heave the lead in eight fathoms of water, and pull an oar in a ship's boat. This public-spirited and admirably trained body of men deserves the fullest sympathy of the Navy, and the latter would be much benefited were there, as there ought to be, 10,000 Naval Volunteers in the kingdom, and at least one corps in every First Reserve district.

IV. General Organization.

The general organization and distribution of the fleet closely concern the efficiency of the *personnel*. At present one-half of the fleet is kept steadily on the home stations, chiefly in harbour. Few blue-jackets can show on their certificates more than eight or nine years', even nominal, sea service out of twenty. Of the half of the fleet on foreign stations a large proportion is sea-going only to a moderate degree. The real time which most blue-jackets spend at sea is very limited.

It is suggested that no cruizing ships be definitely distributed

amongst the foreign stations; but that the ships on the latter be only the flag-ship, the small gun-vessels and gunboats—which are required on several stations for particular purposes—and such coast service and other special craft as the conditions of the station may render necessary. The Mediterranean might perhaps be placed under exceptional regulations. The cruizing ships, at all events the unarmoured, might be formed into a series of flying squadrons, to leave England at intervals of a few months, and show themselves on every station in turn. A careful and not difficult arrangement of their movements might ensure that—without increasing the number of ships in commission—no station need be at any time without a properly concentrated force in its waters. When necessary, ships might be dropped, and others picked up on any station or at any port. In like manner the admirable practice recently introduced in China, of making the ships on the station into a squadron for cruizing, might be more generally adopted even with the smaller craft.

It has already been suggested that Senior Officers of Divisions of Stations might be Commodores. In the same way the commander of a cruizing squadron might be a Rear-Admiral. On many stations the Commander-in-Chief should remain at fixed headquarters, and the cruizing Admiral or second in command should go to sea; the former Officer having of course a despatch-vessel—a "Salamis" or a "Vigilant"—to take him about to visit outlying parts of his command. With this view Bermuda should be made the headquarters of the North American and West Indian station, and the Governor of Bermuda should be Admiral Commander-in-Chief of the fleet or squadron. The garrison should consist solely of marines and marine artillerymen. The same should be the rule at Malta for the Mediterranean, at Hong Kong for China, and, perhaps, at St. Helena for the African station. If the naval ports at home were similarly placed under the Commander-in-Chief, and the garrisons composed of marines and marine artillerymen, the naval defence of the country would be much more perfect than it is now. On the foreign stations specified we should reproduce, to some extent, the conditions at present existing with regard to the Channel Fleet, viz., a stationary Commander-in-Chief at the port and an Admiral commanding the cruizing ships, an arrangement which the splendid efficiency of the Channel Squadron shows to be well worthy of extension. It would be easy to advance cogent arguments in favour of the plan of organization here proposed were space available. The example of the one other naval nation which approaches us in maritime power, France, might be adduced to show how well it would work. Moreover, the former history of our own Navy might be appealed to to prove how advantageous such a system was found in days when, though really less dependent upon the fleet than the Empire is at present, Englishmen felt that their surest hope of enforcing respect from aggressive foreigners lay in the pre-eminence of their naval strength.

The very magnitude of our power on the ocean is a most important factor in preserving the peace of the world. No service in any age has ever attained so pre-eminent a position as the British Navy. Every

foreign nation without exception freely yields to it the foremost place, whilst even the great Army of Germany is not without rivals who would cheerfully try conclusions with it. Our naval strength constitutes a national speciality, which it should be the aim of every subject of the Queen to keep up. No method of "providing an efficient force of Officers and men for the Navy and the Reserves" will be satisfactory, which does not take note of it, and does not also tend to restore the Service to that position which is its right, and which it held when the belief in its necessity and in its might tinged the phraseology of our laws, coloured the Liturgy of our National Church, and breathed a spirit of confidence in time of difficulty in every English heart.

Wednesday, May 17, 1882.

WILLIAM SPOTTISWOODE, Esq., M.A., D.C.L., LL.D.,
President Royal Society, in the Chair.

ON THE FUTURE OF ELECTRIC LIGHTING.

By St. George Lane-Fox, Esq.

The Chairman: My duty this afternoon is very simple, namely, to introduce to you our lecturer, Mr. Lane-Fox, whose name is so well known to the scientific world and the world in general, that it requires very few words on my part. He has prepared himself in the subject which he has undertaken by a long study of electricity, extending now over many years. He has further qualified himself by becoming an inventor, and not only an inventor, but one who has carried his own invention to perfection.

During the last few years, and more especially during the last few months, electric lighting has made very great and remarkable progress. But great and remarkable as this progress has been, I do not think that it is to be compared to the advance that is likely to be made in the immediate future. I shall not, however, in the few remarks I have to make, pretend to withdraw the veil entirely from that future. The subject is too vast and too complicated for me; much of it must be left to the imagination of my audience. I shall content myself with indicating the mode in which I think light will come to be produced by electricity, and I shall begin by replying to one or two pertinent questions which the public are ever asking with respect to it.

They say, first of all, "Shall we ever have the light in our houses?" Next they say, "Shall we have to produce the electric current ourselves?" And thirdly, they ask, "Will it be cheaper, or even as cheap, as gas?"

I shall endeavour to answer those three questions. I think I may say at once that we are now in a position, from our knowledge and our experience, to answer them all in favour of electricity. There is not the slightest doubt in my mind that we shall have the light in our houses; and on the other hand it will not be necessary that the consumer should supply himself with the electric current any more than at the present time he is obliged to supply himself with gas. It would, however, be just as possible for him to do so. The third question is one which involves a great many considerations, but I think I can answer it also affirmatively, indeed I have no doubt that electric lighting will

be cheaper than gas. I will now, if you will allow me, give as nearly as possible the reasons which have brought me to those conclusions.

And first, as to the light and the devices made use of for its production. The light itself, by an improvement in the mode of its production, has lately undergone an important change for the better. People speaking of it hitherto have usually supposed it to have certain inalienable qualities, and some of them very bad ones. They have supposed it to be brilliant, dazzling, flickering, changeful of hue and intensity, unbecoming to the complexion, and so on; in fact, to have many qualities making it unsuitable, if not for signalling or wide open spaces, yet for domestic use. But in so describing the light they have, I think, had in their minds the so-called "arc" light only. Now the arc light has done very much for the progress of electric lighting, and what I am about to say may seem strange and ungracious, but it is, I believe, nevertheless true, that in a short time the arc light will be altogether superseded by the more modern and much more convenient "incandescent" light. I may pause here to point out the impropriety of those names. In all cases light, when produced by electrical energy, is due to incandescence. However, the names have now got a current and popular meaning attached to them, so I will not attempt to further meddle with them here. To proceed, the so-called "incandescent" light has none of the disagreeable characteristics of the "arc" light. It is not too brilliant nor too dazzling; it requires no shade to temper its use; it is neither flickering nor changeful of hue or of intensity, and it is not unbecoming to the complexion. In the "arc" light, the light is produced in the open air by an intensely heated and variable gaseous conductor, composed in part of the common air and in part of vapour of carbon, playing upon and between the points of two carbon pencils, the points of the pencils being, by the action upon them of the gas, raised to a very high degree of incandescence. The gaseous conductor is heated by the electric current passing through it from one carbon pencil to the other. In the "incandescent" light so called, the light is produced in vacuo by the action upon an invariable solid conductor, generally a filament of carbon, of an electric current kept at a constant pressure. It will be seen that the conditions of the two lights are entirely different, and that in the case of the "arc" light the conditions are such as to make variations in the quality of the light produced almost inevitable, whilst in the case of the "incandescent" light the conditions are such as almost to guarantee a light perfectly steady and uniform in its character.

With respect to the device by which the "incandescent" light is produced, most of you are now, no doubt, familiar with at least the outward appearance of the incandescent lamp. It consists chiefly of a glass globe, from which the air has been as completely as possible exhausted, and in which there is a carbon filament mounted on two conducting terminals. Now this sounds very simple indeed, but there are a great many points to be attended to on the part of the manufacturer of the lamp. It is not difficult, and it has not been for several years, to make a good incandescent lamp; but to make a large number of

them, so that they are all good and all alike, is quite a different matter. I do not say it is now difficult, because the difficulties are gradually disappearing, but it required a great deal of work, thought, and study in former times. It introduced altogether new subjects. We have to deal with people other than those engaged in scientific pursuits, and to train them up so as to make them do their work properly. For that purpose we have had to devise a great many means of saving labour, and making it unnecessary that they should think at every stage. I may tell you briefly what the chief points are in the construction of an efficient and durable electric lamp. First, the material solid conductor or carbon filament should be sufficiently strong. Various carbonized substances can be used for the purpose. When I began experiments I used every conceivable material—orange peel, pieces of wood and paper, and vulcanized fibre, and all manner of things. I finally thought it was scarcely possible to get the right material. But by degrees I found that there were other difficulties in the way besides getting the right material. We found we were not getting so good a vacuum as we supposed we were. We thought, when using a Sprengel pump, that if the mercury made a clicking sound in the tube, the vacuum was complete. This was, however, no real criterion. The only way in which we can exhaust a globe or glass vessel is by taking the pressure away from the outside, so that the gas, by its natural expansive power, can force itself out. Now, if in the exhausting apparatus we use there is any opposing pressure, due to the presence of moisture, the residual gas, after a certain degree of exhaustion has been attained, has not sufficient expansive power to overcome it, and ultimately an exact balance between the two is arrived at. The highest degree of exhaustion is thus measured by the actual pressure or tension of any moisture which may have found its way into the apparatus. To shut this moisture out of the pump and hermetically to seal the junctions of the mercury with the glass and sides of the apparatus, I used sulphuric acid, an acid in the form of a liquid which gives off no vapour in a vacuum. This was the first and most important advance I made towards the completion of the lamp. I was obliged, however, finally, to abandon the use of the Sprengel pump and to invent another more adapted for the purpose. My own, I think, is at once more rapid and more effective.

The next point is the necessity of keeping the electric connections between the inside and outside of the globe perfectly hermetically sealed. The only material we can use so as to make a close joint is platinum. There are others that can be used, but not so practical. The difficulty, however, remains that there is still a slight difference between the expansion of glass and that of platinum, the result is that a slight annular space is left between the glass itself and the platinum wire which leads the current into the inside of the globe. I have tried to overcome that difficulty by putting little globules of mercury round the outside of the platinum wire. It gave rise to difficulties at first; but now I think that is very effective in preventing the air passing in between the platinum wire and the glass.

I will not trouble you with any more details of manufacture; but I

will call attention to the material out of which the carbon fibre is made. It is the root of a grass known as French whisk. This material is prepared by boiling it in caustic soda, so as to remove the traces of silica which are to be found on the surface. It is then thoroughly washed, and while still damp wound tightly round and tied upon small blocks of graphite. These blocks are buried in plumbago and intensely heated. By this means a very strong and durable carbon filament is obtained.

The lamp as a whole is exceedingly portable and convenient, and is always quite ready for use. It requires no trimming or adjustment when once mounted in an electric circuit, and it is suitable for use in houses, places of business, &c., as well as in the streets and public places.

We now come to the distribution of electricity, upon which hangs the answer to the householder's question, "Shall I have to produce the electric current for myself?" I hope to be able to show that he will not, and that he will have to think no more about this source of his supply than he has at present to think about that of gas.

A few years ago it was generally believed to be altogether impossible to distribute electricity or the electric current as gas is distributed. A Select Committee of the House of Commons apparently came to that conclusion, in 1878; and it is true that at that time nothing had been done to demonstrate the contrary, or to show that distribution on a large scale, or a scale similar in every way to the scale on which gas is distributed in the metropolis, was so much as practically conceivable. Now things have altered very much, and there is no longer any doubt that electricity can be transmitted and distributed for every purpose, and in every way as easily, if not more easily, safely, and economically than gas.

I propose to describe briefly a system by which this can be accomplished. But before doing so, it may be well, perhaps, to say a few words upon the modes in which the electric current is generated and sent on its way through the system. Most of you are, no doubt, familiar with that, but in case there are some here who are not, I perhaps may be allowed to explain.

I must begin by calling attention to the difference between electricity and the electric current. The difference may be likened to that between air at rest and air in motion. We very commonly talk of there being no air when the air is only very still; but of course we know there is every bit as much air when it is still as when it is in violent motion in the form of a gale of wind. In the latter case, however, the effects are very different, the air when in motion being capable of exercising a very considerable pressure upon whatever opposes itself to its motion. So it is with electricity. When at rest it escapes our observation, when in motion it produces phenomena which are comparable in magnitude and visibility to those produced by the wind. Electricity, indeed, may very well be conceived of as a subtle fluid or gas pervading all matter, and made apparent to us only in its effects, when transferred from one thing to another, and accumulated, or set in motion.

Motion of electricity or the electric current, as it is called, can be produced in a variety of ways. The most important for our present purpose of electric lighting is by a machine constructed for the purpose, and called a dynamo-electric machine. This machine depends upon a principle discovered by Professor Faraday, and which admits, if not of a simple explanation, at least of a simple description. It is this: if a ring of wire be made to move across a "magnetic field," as it is called, that is the space in the immediate neighbourhood of a magnet, a current of electricity will be produced in this wire, first in one direction, and then in the other, according as the ring advances or recedes in crossing the field. This fact is utilized in the dynamo in the following manner:—A wire is wound endlessly upon the rim of a wheel, so that as the wheel revolves the coil is made to cross a magnetic field suitably arranged for the purpose. As this coil approaches the magnetic field, a current is set up in it, and as it recedes this current stops, and another of a precisely similar character, but in an opposite direction, takes its place. No electricity is generated. The electricity is already in the wire. The current, *i.e.*, the backward and forward movement only of the electricity, is produced by the mechanical motion of the coil across the magnetic field. It is almost as if the electricity were the wire itself, and this was set in motion backwards and forwards around the rim of the wheel. It will not be necessary for me to go into this matter more fully. I think if you follow me thus far, that we have in the dynamo-machine electric currents generated in a coil of wire by the revolution of the latter across a magnetic field, you will readily understand how mechanical motion is converted into electrical motion, and how the current itself is comparable in point of movement to the rotation, first in one direction and then in the opposite, of the coil around the rim of the wheel upon which it is made to revolve. The coil of wire is, I may add, elongated so that part of it only actually revolves on the wheel across the magnetic field; the rest, detached, but in free contact with the part that revolves, is stationary, and constitutes the external circuit, as it is called, of the machine or system. It is on the external circuit, variously broken up and distributed for the purpose, but retaining the essential characteristic of the original coil from which it is derived, viz., that it is a part of a coil which wound upon the rim of a wheel revolves across a magnetic field, that the various devices, such as lamps, are arranged for the utilization of the current in the production of light. I may mention that it is not necessary that this external circuit should be composed entirely of wire. The earth is a good conductor of electricity, and may be substituted for the wire in the return portion of the circuit, when it is not necessary that the current should be preserved from waste by insulation. Returns by "earth," however, have a wider signification than returns by actual earth; they include all returns in which the conductor is uninsulated. There is an important detail in the construction of these machines which I have not mentioned; I feared it would complicate the description. However, my conscience pricks me, and I must now at least briefly refer to it. In approaching the magnetic field a current is set up in the coil in a certain direction. On receding

from the field the current is reversed, and proceeds in the opposite direction. Now, generally, it is necessary that this current should in any circuit in which are devices, such as lamps, for the utilization of electricity, proceed always in one direction. This is effected by means of a device called a commutator, whereby as the inner circuit revolves across the magnetic field, now advancing and now receding, the termini of that circuit are brought alternately in connection, now with the positive and negative, now with the negative and positive termini of the external circuit. In this way the current in the external circuit flows always in one direction, whilst the current in the inner circuit flows always, first in one direction, and then in the opposite, in constant and most rapid alternation.

Another important way of giving currency to electricity is by chemical combustion. Batteries constructed for that purpose are of two kinds, primary and secondary. In a secondary battery the chemical condition, which is the immediate cause of the current obtained by its means, is itself produced by the passage through the battery, but in the opposite direction to that of the derived, of a prior current of electricity. The action of this prior current upon the contents of the battery may be likened to winding up a spring, or lifting to a height a heavy weight. The force expended in winding up the spring or in lifting the weight is stored in the new form or position of the spring or weight, ready to come into operation again in the opposite direction the moment it is at liberty to do so. So, in the case of the secondary battery, the prior current which has passed through it has exerted an effect which is stored up in the battery in the form of its chemical equivalent. Given a closed circuit and liberty to act, and this chemical equivalent will revert to its original condition, and a current of electricity in the opposite direction will be the result. This battery, by virtue of its power to store up in a chemical form the energy of a current which has been made to pass through it, and to restore the energy under proper conditions in its original form of an electrical current, is of immense value, and destined, I have no doubt, to play a most important part in the future of electricity. I shall explain by and bye the mode in which I propose to make use of it in my system of distribution.

A primary battery is, at present, of comparatively little value as a source of electrical energy, and it is difficult to see how in the future it can be made to play any very prominent part, so far at least as electric lighting is concerned. In an ordinary primary battery the current produced is far too weak for the purpose, and the requisite strength can be attained only at a most disproportionate cost. I may dismiss this battery, then, with the remark that, as its name implies, it is distinguishable from the secondary, in being a primary source of electrical energy, that is to say, it has already in its composition the conditions requisite for the production of a current, and does not require a prior current of electricity to be passed through it in the opposite direction.

Having prepared the way by explaining the mode in which an electric current of any strength may be produced in a circuit, and

the mode in which electrical energy may be stored in a secondary battery, I will now proceed to describe the mode or system by which I propose to distribute the electric current, so that it shall be at all times at the point or points, in the house or in the street, at which its energy is required for the production of light in a lamp such as I have described.

I choose a central station with a due regard to the area over which I have to supply the electric current. I there set up my dynamos. To put them in motion it will be necessary to have one or more steam engines, or a convenient fall of water. My central station then will comprise a source of mechanical motion proper to set the dynamos in motion and the dynamos themselves. I have now to distribute my external circuit, the vehicle of the electric current, and to set up at various points of the system the secondary batteries which I have already described. The external circuit in its ramifications will very much resemble the mains, submains, and pipes of a system of distribution for gas, only that the mains, submains, branches, and wires of the external circuit will be solid, much smaller, and, to prevent the waste of the current on its way to the lamps, insulated. A wire, precisely as in the case of gas, will proceed from a main, submain, or branch to each point in a street or house at which it is proposed to erect a lamp. At the entrance into a house, the size of the wire will depend upon the size of the house and the number of lights intended to be used, just as at the central station the size of the mains will depend upon the extent of the area over which it is proposed to distribute the current, and the number of points at which it is proposed to utilize it in the production of light. At the points in a house where the lamps are attached, the wires will be about the size of an ordinary bell-wire, and as easily manageable, and, I may add, as perfectly harmless. There is no danger either of shock or of fire to be apprehended in a properly arranged system. In such a system as I am describing, I should not propose to use a current having a higher tension than, say, 100 volts. And at this tension, or indeed as has lately been proved before a Committee of the House of Commons, at a tension of twice that amount, a shock would be absolutely out of the question, and fires in such a system could happen only from what is called "short circuiting," which is perfectly avoidable, and need not ever happen.

I have said that the size of the mains at the central station will depend upon the extent of the area over which it is proposed to distribute the current and the number of points at which it is proposed to utilize it in the production of light. That, however, is only true on the assumption that secondary batteries are not made use of as reservoirs of electricity, and that the current is supplied as it is wanted from the central station alone. In that case the whole of the plant at the central station, including the source of motive power and the dynamos, as well as the mains and submains, will have to be adjusted so as to supply the maximum quantity of electrical energy which may at any time be required in the district. Such an adjustment it is obvious would be proportionately expensive. Moreover, as

the engines would be at work only when light was required, and at their maximum very rarely indeed, it is clear that the plant would for a great part of every day and night be lying idle. Another disadvantage attending such a system would be the entire dependence upon the central station for the supply of the electric current. Should any accident happen at that station, so that the engines were thrown out of gear, there would be an immediate arrest of the current, and, assuming the district to be lighted at the time, total darkness would ensue.

To avoid the necessity of adjusting the plant at the central station and the mains and submains to a maximum, and to avoid also the entire dependence of the district upon the central station for a supply, I propose to set up at various points in the district, and in connection, on the one hand, with the mains and submains, and, on the other hand, with the earth, secondary batteries as reservoirs of electrical energy. These batteries may be distributed at pleasure, and according to the exigencies of the case. Their action, assuming the plant at the central station and the mains and submains to be adjusted to an average supply only, would be as follows:—The dynamos would work night and day. The current in the daytime, when not many lamps are in use, would be brought to a stop at the lamps at which the taps were turned against it. The current, not finding any outlet, would accumulate in the system until it acquired a pressure sufficient to overcome the pressure of the secondary batteries. And here I must explain that a secondary battery offers a certain resistance, dependent upon the number of its cells, to the passage through it of the electric current. This resistance can be fixed in any battery in the system, so that it shall not be overcome until the pressure of the current seeking to enter has attained a certain superior intensity. This intensity, then, being reached, the current will enter the battery, and passing through it to the earth, will produce those effects which I have already described, and the energy of the current will be stored up in the battery in the form of its chemical equivalent. Later in the day, and in the evening, when more and more lamps are brought into use, the current will cease to seek an entrance into the batteries, and will make its way through the new openings afforded to it at the various lamps. Finally at night, when a great demand is made upon the current for all the lamps which may then be lit, a demand which the engines as adjusted could not alone meet, the pressure at the batteries will be removed, and the electrical energy which has been stored up in them during the day will issue out, and will supplement the current which is being supplied to the lamps from the central station. This supplemental current is now independent of the central station, and will flow on, though the latter should be entirely disconnected from the system.

It is in this way that I hope in my system to avoid the cost of a great central station, erected to supply the maximum quantity of electricity that can ever be required, and at the same time to ensure a constant supply of the electrical energy.

I have now to describe the mode in which I attach the lamps, and

constitute the return portion of the external circuit. And here I would pause to sketch what I conceive will be the probable division of labour and proprietorship in the installation of a system of electric lighting.

I think that all I have hitherto described, with the exception of the wires inside the houses, which I may call the house-wires, will certainly be, if not the original work, at least the property of one company, corporation, or person. It may be that the erection of the central station and of all that pertains to it, and of the lamps in public places, will be the work of one set of contractors, and that the laying down of the mains, submains, branches, and subbranches, together with the secondary batteries, will be the work of another set of contractors, and that finally the introduction of wires and lamps into houses will be the work of another set of persons corresponding to the retail gasfitters. But it is probable that when once constructed all the works which may be characterized as out of doors, viz., the central station, the distributing network of mains, submains, and branches, together with the lamps in the streets, and their return connections, will be the property of, and will be maintained by, one set of persons, whilst all the works which may be characterized as indoors will be the property of, and will be set up and maintained by, the owners of the houses, precisely as gas pipes and gas fittings are at the present moment.

We will assume then that the outward portion of the out-of-door external circuit, with its mains, submains, branches, and subbranches, has been laid down in all the streets and to all the houses where the light is intended to be used. It is now necessary to extend the outward portion of the indoor external circuit, to attach the lamps, indoors and out-of-doors, and to constitute the homeward or return portion of the circuit.

I have said that the size of the wire or branch introduced into a house will depend on the size of the house, and the number of lights which it is intended to have. From this branch, as from a main, a system of subbranches and wires will be led all over the house, and into all the rooms and offices where it is proposed to have the light. Our outward portion of the external circuit is now complete: it remains only to attach the lamps, and to constitute the return.

I will take a single house as an illustration. The mode of fixing the lamps and of constituting the return is the same everywhere, both indoors and out-of-doors, and what I am about to say will apply equally to all portions of the district.

I must here call your attention to an important feature of the system I am now describing, which I have not yet alluded to—I mean the constancy of the electromotive force, or of the pressure of the current at the various points of the system. In order that the lamp-fitter may know what kind of lamp to use, and that the lamp, when fixed, may always have just the requisite amount and strength of current to make it properly incandescent, and not either more or less, I propose that the electromotive force, or, as it may otherwise be expressed, that the pressure of the current shall always be as far as possible constant, whatever may be the demands upon the current

at the various outlets of the system in respect of quantity. I do not mean that the pressure shall at all points be the same—that is not necessary, nor perhaps is it possible; but that the pressure at any one point shall, as far as is possible, be always the same. The mode in which I propose to ensure this, I will explain by and by. For the moment, it is enough if I mention the fact. The pressure then of the electric current at the point where it enters the house will be ascertained by the lamp-fitter; it will probably be registered on the wire itself, and he will choose his lamps accordingly. Each lamp made according to my invention bears upon it the particulars requisite to assist him in his choice, viz., both the candle-power of the lamp and the strength of current necessary to make the lamp incandescent. The lamps having been selected, the mode in which they shall be arranged is the next question. They may be arranged either in groups, like the gas jets in a chandelier, or in series along a frieze, or separately one by one, like ordinary gaslights, lamps, or candles. They may also be arranged so that they shall be lighted or extinguished simultaneously, or separately. In any case the mode of fixing the lamp and completing for it the return or homeward portion of the circuit is essentially the same, and is as follows:—I have described to you the incandescent lamp. It will be bought or supplied complete. It will be found to have two copper wires or terminals proceeding from the neck of the lamp, and in contact or electrical communication with the filament of carbon hermetically sealed within the globe. To fix the lamp, or join it up in circuit, one of the terminals of the lamp—it is immaterial which—is attached to the wire already in the room proceeding from the central station, and the other terminal is connected with an uninsulated conductor in communication also with the central station. This conductor will usually be found ready to hand in the form of a water-pipe. Where such does not exist, the wire will have to be prolonged, if necessary, until it can be attached to something which is a good conductor and in contact with the earth. In all cases I should propose to use the earth, in some way or other, as a portion of the return of the external circuit. It serves the purpose perfectly well, and it is of course much less expensive and troublesome than a conductor, a wire for instance, made for the purpose, though of course the latter can be made and be supplied from the central station, together with the outward bound wire or insulated conductor if preferred. Such is the mode, a perfectly simple one as will be seen, in which the lamps will have to be fitted on to the electrical communications in the house. The return circuits of all the lamps in the house, I ought perhaps to add, may first be brought together, if that be more convenient, and then be collectively connected with some single return conductor such as I have mentioned.

It remains now to describe the way in which the current is controlled, so that it shall pass through a given lamp or series of lamps, or be arrested at pleasure. This will be immediately understood if it is remembered that, for a current to pass at all, there must be a completed circuit. Every lamp, when incandescent, is on a circuit; that

is, its filament of carbon forms part of a complete circuit, which may be described as being composed of the internal circuit of the dynamo machine, and of a portion, complete in itself, of the entire external circuit. Thus, the component parts of such a circuit will be the internal circuit, and of the external circuit, main, submain, branch, subbranch, we will suppose, wire into house, wire upon which lamp is fixed, lamp itself, return wire of lamp, return of system, and so on back to the other pole of the external circuit. Now, if this circuit is broken at any point of the external circuit between the dynamo and the lamp, the lamp will be extinguished; so if the connection be restored, the lamp will, assuming the dynamo or the reservoir to be at work, again and instantly become incandescent. An apparatus, then, resembling an ordinary gas tap, may be put up at any point or points on such portion of the circuit, and it will control all the lamps which lie beyond it. The circuit may be broken and restored at pleasure by such means at the central station, at any point or points of the mains, submains, and branches, at the entrance of the wire into the house, an arrangement which would control all the lamps in the house, and at any point between such last-mentioned point and any lamp, group, or series of lamps which it may be desirable to control in a group, a series, or singly. The apparatus consists only of a device for breaking and reconstituting the material circuit.

I have now described the system of distribution so far as relates to the central station, the mains, submains, and branches, the secondary batteries, the lamps, and the return portions of the circuit. I have yet to say a few words about (1) the means for keeping the electromotive force of the electric conducting mains constant, and (2) the means for measuring the quantity of the electricity used.

The electric current may be conceived of as the still electricity of a completed circuit set in motion in endless rotation around the circuit, more or less of the electricity resident like tranquil air in the system being set in motion according as more or less power is brought to bear upon it. Now, assuming that in a given circuit a given power sets a given quantity of electricity in motion with a given pressure, it is obvious that if that circuit be extended, the current in motion will be distributed over a wider area and will flow, the force producing it remaining the same, in shallower streams, so to speak, and with diminished energy. Hence, as in any system of distribution such as I have described, the circuit is perpetually changing in extent, now at night, now in the daytime, by the addition and withdrawal of the particular circuits upon which particular lamps or sets of lamps are placed, a circuit being added or developed when a lamp is lit, and withdrawn or choked up when the lamp is extinguished, it is apparent that if the pressure of the current at any point, as at any lamp for instance, is to remain constant, some means must be at hand for increasing and diminishing, in exact proportion to the demand, the power to which is due the motion of the electricity in the entire system. These means are (1) additional generators or dynamos, (2) secondary batteries, and (3) a regulator or apparatus specially constructed for the purpose. By these means severally, or, best in combination, the

power can always be adjusted to the exigencies of the case, and, however variable the demands upon it may be, the energy of the current at any point be kept practically constant.

The measurement of the quantity of electricity used, *i.e.*, of the quantity of electricity which has passed any particular point, presents no insuperable difficulty. I have an electrical meter here which is constructed for that purpose. It is not perfect yet; it is too complicated. I have no doubt, however, that in a very short time it will be perfected, so as at least to be fit to make a start with. I need not explain it in detail. It will be sufficient, perhaps, if I explain the principle upon which it and all such meters are constructed. The only difficulty is in the application of the principle, and that, as I have said, is not in any way insuperable; it requires only a little time and thought to be overcome completely. The principle, then, is this. The movement of that which has to be measured has to be translated into a movement of something which will vary precisely with itself, and at the same time leave a visible, legible record of the movement which has been accomplished. This translation will be readily understood if you recall to mind how the movement of the wind is recorded upon a diagram by lines which rise and fall with its pressure, and how other quantities, variable in degree, may be so adjusted as to make their variation tell upon an indicator, which in its turn shall leave a permanent record of the amount of variation to which it has been subject. And you will remember how in the system now under description one kind of force has already been translated into another in the production of the electric current by means of mechanical motion. The meter, when perfected, would be put up at whatever point or points it was desired to know the quantity of electricity which had passed that point. For instance, a meter at the central station could be made to measure the quantity supplied to the entire district served by that station, a meter at the mouth of a secondary battery could be made to measure the quantity which had gone into or had come out of that battery, and a meter in a house could be made to measure the quantity which had been supplied to that house. The meter, in order to measure the current, would have of course to be constituted a part of the circuit, or to be placed upon a shunt, as it is called; that is, upon a branch circuit so constructed that a definite proportion of the total current requiring to be measured shall flow through it.

I have now, to the trial of your patience, I am afraid, described how I conceive the electric current may in any district be distributed and be brought to the houses of the consumers without any other trouble in kind, and with much less, I think, in degree, than is incident to the consumption by them of gas. The householder will have the current laid on to his house at a known and constant pressure day and night. He will be able to determine for himself to what extent, in what rooms, and in what modes, and to what purpose he will apply it. And he will be able to choose for himself the particular lamps, whether Edison's, Maxim's, Swan's, or my own, which he may deem most suitable for his purpose. He will be left at perfect liberty. The

only demand upon him will be a demand from the central station for the price of the quantity of electricity which the meter in his house may record against him. And I may leave this part of my subject with the expression of my hope and belief that that quantity will ere very long be found to be in every case very large indeed!

Now, I should like, if you will allow me, to go into the third question, the question, viz., of the economy of electricity as compared with gas. I may first say that my reason for believing that the incandescent lamp will ultimately supersede the arc depends not only on its great superiority in point of convenience and easy management and steadiness, and the fact that its light has no colour; but I believe that in time it will actually prove to be more economical. In the arc light it is necessary to remove the carbon pencils from time to time as they burn away. This removal is expensive, requiring as it does skilled labour for the purpose. An incandescent lamp once mounted requires no attention, and if properly made will last so long good that its cost may be thrown out of account in any estimate that may be made of the comparative economy of electricity and gas when that lamp is used. This gives a great advantage to the incandescent over the arc lamp. In the estimate I am about to make I shall assume that the former lamp is used, and I shall not take its cost into the account. I must premise that of course we have not got actual results to go by on a scale anything comparable to gasworks, so that we cannot give figures of what has been done. Still I think our knowledge of the subject justifies me in drawing some conclusions. We know that by the expenditure of a certain amount of fuel we can produce a certain amount of power. We know that on a large scale, and with good machinery, a combustion of $1\frac{3}{4}$ lbs. of coal will yield one horse-power for an hour, and we know what one horse-power will do in producing light by incandescence; we know that that amount of energy expended in raising a certain extent of surface, whether continuous or broken up into several lamps, to a certain temperature, will produce a total light equal to 150 candles. Knowing then that an expenditure of one horse-power is about equal to an expenditure of $1\frac{3}{4}$ lbs. of coal per hour, and that by the expenditure of one horse-power we can get a total light of 150 candles, we can calculate on that as a basis. Supposing that we took the cost of fuel to be about one-third of the total cost or expenditure for the production of energy—I think we may fairly assume that, if we take the case of very large works, works on a really large scale—we could then retail energy at one farthing an hour per horse-power, that is to say, we could actually produce the power, and sell it at a profit at that price. It seems a low figure, but if we remember we are to have works for the sole purpose of developing energy, the cost will surely be very much lower than where the actual production of power is quite a subsidiary matter, as it is in ordinary factories. I say that a farthing is a very fair estimate of the cost of horse-power per hour. I wish to press that matter very strongly, because the result I am going to arrive at is very astonishing. An ordinary gas jet, burning five cubic feet per hour, taking an average price, costs one farthing per hour. Now I

have shown that energy can be produced at the rate of one farthing per hour per horse-power, and that will produce light equal to 150 candles. An ordinary gas jet is equal to twelve candles only, so that for the same price twelve times as much light can be produced by electricity as by gas. Probably that seems an extraordinary result, but it is within the region of probability.

I should like before concluding to show how electricity can be used for other purposes besides lighting. We have already seen that one horse-power per hour can be produced at a certain price—one farthing—and this represents a certain amount of heating energy, which can be utilized in any way you please. It may be used to raise a lower temperature to a higher in the case of water, coffee, chocolate, and so forth. Here is a cylindrical cup or apparatus (describing), consisting of one cylinder enclosed in another, intended for that purpose. There are two terminals, one to be connected with the main, the other with a return conductor. On making connection with the main, the current would pass through a length of wire coiled round the outside of the inner cylinder, and between it and the outer cylinder, the two cylinders together forming the sides of the vessel. The larger portion of the heat-energy would be absorbed by the inner cylinder, and the inner surface of the vessel would become hot. If there is a liquid inside the vessel that liquid would take up the heat. The wire is surrounded on the outside by flannel or felt, so that the heat may not be lost by radiation to the outer cylinder, which, again, protects the flannel or felt, and keeps it from wearing away.

This particular apparatus holds, I think, about a quart, and the energy which would have to be expended upon four of these incandescent lamps would be sufficient to make it boil in about five or six minutes. Now if we imagine for an instant what that really means we can see that the cost will be very small indeed. The energy requisite for the incandescence of four lamps for a few minutes would be much cheaper than gas, would be indeed next to nothing. I believe in the not distant future we shall have an apparatus similar to this in construction in all our kitchens for boiling, stewing, or roasting, or any other kitchen purpose.

I should also like, had I time, to refer to the application of electricity to motion, but I do not think that I can venture to go into that now. We know, however, that there are certain useful forms which electricity can take, such as light, heat, and development of motive power; and when once we have got electricity laid on to our houses we shall find these, and perhaps a great many more uses for it. We can hardly imagine the changes it will introduce into our daily life: one thing is that it will save us all a great deal of time. We shall have no trouble in the lighting by electricity as we have with gas; we shall have always only to turn a cock to have it on or off; it will be always ready at any moment if we have a proper system of distribution and storage, and so I can imagine that when once it is in the hands of the public they will make good use of it, and find many other applications for it which have not yet been found. It is really only a matter of time how long or how soon this extraordinary change will come about.

I thank you very much for the kind patience with which you have listened to me.

The CHAIRMAN: I am sure we must all thank Mr. Lane-Fox for the exceedingly interesting lecture he has given, and the various illustrations he has afforded as to the use and economy of electric lighting, and last, but not least, its application to domestic and cooking purposes. I now call upon gentlemen present who may desire to offer any observations on the paper, or to ask any questions that may occur to them.

Mr. FORSTER: May I ask Mr. Lane-Fox if there is any danger connected with the use of electricity?

Captain VERNEY, R.N.: I should like to ask what is the advantage of placing the secondary batteries in various parts; and whether it would not be better to have the secondary batteries all together at headquarters. I should like also to ask whether Mr. Lane-Fox contemplates that incandescent lights can be made applicable to lighthouses or naval signalling. I understood him to say they could not, and that the arc light would have to be applied to such purpose. If that is the case I hope he will be a little forbearing towards those who are turning their attention to the arc light, and allow us to have the arc light, which, to us naval men, is of considerable importance. Then, in the future of electric lighting, I hope Mr. Lane-Fox will be able to promise that we shall have new incandescent lamps gratis; and that when a lamp is broken we shall have another for nothing, because otherwise we shall have people giving to us all sorts of inferior lamps. There will be no future for electric lighting unless they do as in America—give us new lamps gratis, in order to encourage us to use the electric light. Mr. Lane-Fox has not held out to us any hope of producing the electric light by means of chemical batteries. At the Paris Exhibition there was an excellent constant form of bichromate of potash battery by M. Baudet. He had 36 cells, which he told me required renewal only once a month, and I think it was one of Mr. Lane-Fox's lamps that I saw well and efficiently lighted by the 36 cells. If gentlemen would hold out any hope that by the chemical batteries we could use the electric light, it would be a great deal to say in favour of it. I do not know if any ladies or gentlemen present have visited the Crystal Palace Exhibition; but I think those who saw the Paris Exhibition must have been greatly disappointed with the general poorness of the display made at the Crystal Palace. Anybody, however, who has visited the Alhambra Court lately must have been greatly struck with the beautiful manner in which that building has been lighted up by Mr. Lane-Fox's own light. I do not think there was anything in the exhibition that could compare with that; and I hope that those who have not been there already will go, in order to see the place lighted up by Mr. Lane-Fox's own arrangement, because I think it is one of the most beautiful sights to be seen in or near London at the present time. I should like further to ask whether in calculating the comparative economy of the electric light, Mr. Lane-Fox has taken into consideration the substitution of gas-engines for steam-engines.

Professor LAMBERT (Royal Naval College, Greenwich): I should like to ask Mr. Fox a question or two. He was kind enough to tell us at the beginning of his lecture that he thinks himself safe in promising us in the very near future a very high development of electrical discovery. I shall be very glad if he will tell us in what particular direction he anticipates this discovery will be. May we hope for a utilization of the waste forces of nature or for any large diminution in the great waste of energy which at present attends the subdivision and distribution of the electric current? Any information of that sort, I am sure, will be acceptable. In the estimate which Mr. Lane-Fox has given us of the relative cost of gas and electricity, he has certainly startled me by the cheap rate at which he has promised us that electric energy will soon be retailed to householders. I would ask him if he has considered the loss that takes place when the work of the steam-engine is transformed into electric current—whether that has been taken into account fully, and also the leakage which will no doubt take place when a current of high potential is distributed over the series of mains. I think he has omitted to mention the cost of the lamps themselves and the length of their lives. Mr. Edison, I think, values the life of his incandescent lamps at about 1,000 hours. Mr. Lane-

Fox has mentioned that especially good lamps with which he is acquainted himself have lasted 1,500 hours, and perhaps more. When estimating the cost of electric lighting in our houses, we must not forget that the lamps will become deteriorated in time, and will often get broken. Servants will not use them more carefully than the gas globes of the present day. I believe the cheapest incandescent lamp now on the market is Mr. Swan's, and that he has reduced the price to 5*s*. Now, an ordinary gas burner giving the light of 10 to 15 candles will consume in 1,000 hours a quantity of gas which will cost about 7*s*. 6*d*. The same amount of light supplied by electricity would, it appears, require a special expenditure of at least 5*s*. for the lamp alone, exclusive of the cost of the current. It seems to me that this is a very serious item for consideration. I am very glad to have heard from Mr. Lane-Fox that probably the incandescent lamp may in the future be made to last for almost an indefinite time, and a great advance will have been made when this is realized. We are told that it will be possible to supply electrical energy at the rate of a farthing per horse-power per hour. I should like to ask Mr. Lane-Fox if he knows of any instance in which any approximation has been made to this economical way of retailing it.

Sir LUMLEY GRAHAM: I should like to ask Mr. Lane-Fox whether, in estimating the relative expense of lighting by electric light and by gas, he took into consideration with regard to gas the return which can be received from the sale of the residue after the manufacture of gas. I believe there is a very large return indeed to be got from this.[1] I have no shares in gas myself, so I do not speak as an interested party. Then there is another question in regard to the electric light. Is it possible to diminish the light at pleasure as we do gaslight, which is manifestly a convenience?

Mr. LANE-FOX: In answer to the first question as to the danger of electric lighting, I may say that I have heard a great deal about it; but I do not think that there is anything in it. The danger takes two forms: first of all, the danger of shock, and of the physiological effect it will produce; and secondly, the danger as to fires. As I have already pointed out, the tension in the method of distribution I propose will be comparatively very low, and it is only when the electricity is pressed or raised to a very great degree of strain that it is able to overcome the resistance of the body to such an extent as to produce any serious result; and I do not think that in any practicable scheme, such as will be adopted in the future, such a high degree of strain will ever be required. The difference between high and low tension is simply this. In the first case, we use a small quantity of electricity, driving it away and making it do a great deal of work; in the second case, we use a larger quantity of electricity and do not drive it to such an extent. The cases are similar in their results with regard to work; but they vary in their means, much as a high-pressure steam-engine differs from a low-pressure engine. In regard to the danger from fire, I think I may answer that altogether in the negative. If proper people take the thing in hand and proper precautions are taken, I do not think there will be any danger at all. The only accidents that occur in that respect are due to the grossest carelessness and negligence. A question has been asked by Captain Verney as to the arrangement of secondary batteries in the system of distribution I have described. He asked why they should always be put together at the works instead of being distributed. The reason is simply this: that by putting them at a distance from the works, we can proportionately diminish the size of the conducting mains between the works and the points of the system where the secondary batteries are placed. If the secondary batteries were all collected at the works, the mains would have to be of a size sufficient to carry off the maximum current which would at any time be required; whereas, by putting them at a distance, the electrical energy will be already accumulated near to the points where it will be required, and will not have all to pass through the main conductors at the times it is being drawn upon.

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[1] For instance, I know that a certain gas company in the North of England realized more from their residual products than they paid for the coal used during the latter half of 1881; thus: Cost of coal, 739*l*.; sale of residue, 753*l*.—L. G.

Another question was asked by Captain Verney as to the use of chemical-acting batteries in the place of the dynamo machines. I have a great hope that there may be a possibility of gas batteries being used some day; but that form of battery is at present insufficiently developed. Some experiments have lately been made with gases at a high pressure; but I do not know how far they have been made successfully, nor can I hold out any immediate hopes that we shall derive any practical benefit from them. This I will say, that the battery at the Paris Exhibition, alluded to by Captain Verney, cannot be used, because zinc as a fuel is very expensive: it is about a hundred times as expensive as coal; and so I think there is little chance of its being used in practice. Professor Lambert asked about the direction or line in which I anticipated that electrical discoveries would be made in the future. I think I had inventions in my mind rather than discoveries when I spoke of the future. I do not see that there is any great room for discovery. The laws governing electricity have been so thoroughly investigated by scientific men, that it is really only left to us to apply these scientific discoveries practically, and invent means to make them useful to mankind. Then the Professor asked a question as to the loss from translation of energy from one form to another. I took that into account. I estimated that the total loss occurring between the production of the energy in the form of motion to its utilization in the lamp would be about 30 per cent.: but my calculation was very rough. I was merely speaking then of what was really practicable, because I wished to put, in the strongest manner possible, what really can be done in future by means of electricity. I did not mean for a single instant that it was the sort of thing that was being done now. I think I laid particular stress upon that; what I meant to do was to make an estimate of what would probably occur at no very great distance of time. Then there was a question as to the use of refuse products in gas. I took the actual price at which gas is being supplied, and I presume that the gas companies in fixing the price take into account the refuse products which they also sell, and the sale of which must of course lower the price at which they can afford to sell the gas at a profit. I took, therefore, the price which they charged. Then Captain Verney asked a question as to the substitution of gas for steam-engines. I have not made many calculations in regard to gas-engines, but it is a matter that is developing so rapidly, that it is impossible to say what may be done soon. I think that it is within the limits of possibility that the gas-engine may suit us, but it certainly has not helped us much yet.

The CHAIRMAN: I have to ask the audience to return their best thanks to the lecturer for the lucid explanation of the subject he has given to us to-day. He himself has been over the whole field, and has shown his acquaintanceship with the subject from the powerful exposition he has given. His subject is the Future of Electric Lighting. Now, although it is, generally speaking, dangerous to prophesy about the future of scientific progress, yet, contrary to most subjects, electricity presents this peculiarity, that it is perhaps safer to prophesy what it can do than what it cannot do. The rapidity of its extension, and the variety of its ramifications have been so great, that few of the opinions hazarded as to what it could not do have been borne out by events. As an instance, I may mention the evidence of several eminent men given before a Select Committee of the House of Commons a few years ago, as to the improbability of a complete solution of the problem of the subdivision of the electric light. Since that date the problem has been solved; and for a practical solution we are largely indebted to the knowledge, the skill, and the ingenuity which have been brought to bear upon it by Mr. St. George Lane-Fox himself.

ON COMPASS CORRECTION IN IRON SHIPS.

By Staff-Commander E. W. Creak, R.N., of the Admiralty Compass Department.

The natural desire of the navigator for a compass which should be free from error on every direction of his ship's head, has, during the present century, led numerous ingenious inventors to construct and patent means to attain that object. With the notable exceptions which are about to be considered in this paper, these inventions have generally failed in consequence of their authors being insufficiently informed as to the cause of the errors they had undertaken to correct.

Even now, with all the appliances we possess, and with the aid of some of the greatest scientific men of the day, success has only been so far attained as to provide a compass which shall be correct on every point to the value of a degree at a given time and place. No assurance can be given that this correction will remain constant even for a few days, and it may further be considered certain that it will not be so on a change of the vessel's geographical position.

Compass correction is, however, in most modern vessels necessary to safe navigation, to squadrons sailing in close order and subject to alteration of course simultaneously of great value, and with very few exceptions, is an improvement in every kind of vessel.

Some of the navigators of the last century have declared how troubled they were to find that their compasses gave anomalous values of the variation when their vessels were sailing in different directions in the same part of the world, but as they did not know the laws which governed the observed errors, they consequently could not provide a corrector.

In the early part of this century, Captain Flinders, partly during his command of His Majesty's ship "Investigator," when surveying the Australian coasts, and afterwards during his prolonged captivity in the Isle of France, discovered the laws which governed the deviations of the compass in ships of his day, and with truly scientific method subsequently invented a means for correcting them. His corrector consisted of one or more vertical iron bars bolted to the deck before or abaft the compass, with the upper ends level with the compass-card.

The details of Flinders' investigations are contained in a remarkable report to the Board of Admiralty in 1812, showing that its author was far in advance of his day in all matters relating to the compass on board ship. It may also be noted here, that the late Captain E. J. Johnson, in his work on the deviation of the compass,

published in 1852, gives a list of fifteen wooden sailing ships of his day, in which Flinders' bar would have approximately corrected their standard compasses in all latitudes, the maximum error in those ships being about 5° on the east and west points, and nearly zero on the north and south.

With the introduction of iron ships came largely increased deviations even of the most favourably placed compasses, and a new analysis of these observed deviations became necessary. It is now generally well known that Sir George B. Airy, then Astronomer Royal, undertook this important work, and in 1839 announced his invention of compass correction by permanent magnets and soft iron. This invention forms the basis of every system of correctors in the present day which is worth mentioning.

Following the iron ships of twenty-five to thirty years ago, ships plated with armour and with iron decks were built, bringing new complications into the deviations of their compasses. The investigations of Archibald Smith and Evans, during the years 1860–68, resulted in a new analysis suitable to these altered conditions, which, with practical rules for applying it, will be found in the "Admiralty Manual for Deviations of the Compass," now in its fifth edition. Here also will be found a chapter on the mechanical correction of compasses.

As this latest analysis is necessary to the exact application of correctors, it may serve to render the subject clearer if the deviations observed at the standard compasses in one of four different classes of Her Majesty's ships be analyzed and tabulated according to the system of the Admiralty Compass Department.

Preliminary Observations.

The observer, provided with a small magnetic needle—with special pivot—for horizontal vibrations, and a small dip-circle and needle for vertical vibrations, finds at a place on shore free from local attraction the time of ten vibrations of each needle. On reaching the ship vibrations similar in every respect are made at the standard compass position. The ship is them swung and a complete table of deviations observed on thirty-two points. After this, horizontal and vertical vibrations must be again observed, with the ship's head in a widely different direction from that of the first set. The necessary calculations having been made from these observations, the coefficients of deviation will be obtained and the compass can be corrected for the place of observation.

If, however, it be desired to have the analysis as complete as in the following table, for the purpose of computing probable changes in the deviation or applying a Flinders' bar as a corrector, the ship must be swung again near the magnetic equator, or still better in south dip.

The magnetic forces in an iron, and also in an iron armour-plated ship, proceed partly from sub-permanent magnetism in hard iron, and partly from transient induction in soft iron. In the table, P, Q, R represent the forces produced by sub-permanent magnetism in hard

iron acting in three directions,—fore and aft, athwartships, and vertically. Also a and e represent the forces produced by horizontal induction in horizontal soft iron fore and aft, and athwartships; and c, f, and k, those caused by induction in vertical soft iron acting fore and aft, athwartships, and vertically.

Coefficient λ shows how much the mean directive force acting on the needle is reduced, *i.e.*, if the earth's force cause the compass on shore to point to the north with a force $=1{\cdot}0$, on board ship that force may be reduced to $0{\cdot}85$ or less, thus giving the other disturbing forces more power to produce deviation. A knowledge of this coefficient is necessary to the exact correction of the heeling error.

Table of the Magnetic Elements at the Standard Compasses of four different classes of Her Majesty's Ships before Correction.

	Ship's name	"Nelson." Iron. Armour plated.	"Raleigh." Iron cased with wood.	"Comus." Iron and steel cased with wood.	"Albatross." Composite.
	Positions of swinging	Devonport. Simon's Bay.	Spithead. Simon's Bay.	Sheerness. Simon's Bay	Sheerness. Rio deJaneiro.
Coefficients of deviation.	Semicircular B	+16° 36′	+11° 46′	+17° 30′	+16° 33′
	Semicircular C	− 4 7	+15 15	+ 2 0	+ 6 17
	Parts of B—				
	From hard iron P.	+19 46	+12 45	+10 33	+12 18
	From soft iron e..	− 3 10	− 0 59	+ 6 57	+ 4 15
	Parts of C—				
	From hard iron Q.	− 4 7	+15 15	+ 2 0	+ 6 17
	From soft iron f..	0 0	0 0	0 0	0 0
	Quadrantal D.....	+ 4 0	+ 6 33	+ 6 9	+ 3 59
	Parts of D from soft iron $\pm a$.	− 3 52	− 2 29	+ 1 0	+ 0 34
	Parts of D from soft iron $-e$.	+ 7 52	+ 9 2	+ 5 9	+ 3 25
	Mean horizontal force on board to north, λ	·830	·833	·932	·951
	Heeling error for 1° of heel of ship	+ 0° 31′	+ 0° 33′	+ 0° 22′	− 0° 10′
	Parts of heeling error				
	From vertical induction in horizontal soft iron of the form $-e$.	+ 0 39	+ 0 47	+ 0 26	+ 0 18
	From hard iron R, combined with soft iron k	− 0 8	− 0 14	− 0 4	− 0 28

Note.—The sign − before a and e denotes that the form of iron which they represent is continuous in its relation to the compass—such as iron beams, decks, and keel. The sign + that the iron is divided, as in the case of the soft iron correctors.

Of these elements, P can be corrected by permanent magnets placed

in the fore and aft direction, Q by magnets athwartships, R by a vertical magnet, taking care that the centre of each magnet lies in a vertical plane passing through the centre of the compass. Also $-e$ by masses of soft iron on the starboard and port sides of the compass, and c, f, and k by a vertical soft iron bar with the upper end nearly on a level with the compass-card. a is masked by the invariable excess of $-e$, and requires no correction. λ is much improved by correcting $-e$.

When the standard compass is necessarily placed out of the midship fore and aft line, or there are turrets so placed, two additional coefficients are obtained from the deviation table, A and E. Thus the magnetic forces which give rise to a true A and E are produced by horizontal induction in soft iron unsymmetrically placed. A can be corrected by adjusting the needles on the card, according as its value is + or −; but as it is a constant error on every point of the compass, and each compass in a ship would require special cards if the needles be moved, it seems better to leave it uncorrected. E can be corrected by moving the soft iron masses on each side of the compass into an oblique direction, according to the relative values of D and E.

Having learnt from the table the values of the several components of the total deviation at the standard compasses of four ships which require correction, the two most recently proposed systems of correctors devised by Sir W. Thomson and Lieutenant Peichl, of the Austro-Hungarian Navy, may now be considered as to their suitability for this purpose.

Sir W. Thomson's System.

Partly with a view to making the correction as exact as possible, Sir W. Thomson has invented a compass-card the needles of which are much shorter and of considerably less magnetic power than those hitherto in general use. By this means any induction caused by long powerful needles in the soft iron correctors is obviated.

For the correction of $-e$, a large portion of the heeling error from vertical induction in transverse iron, and part of λ, hollow or solid soft iron globes are employed of varying diameter according to the value of D. This correction remains perfect in all latitudes. Globes have been adopted in preference to other forms as being more symmetrical in action as correctors, and having the further recommendation, that by a simple formula the amount of λ corrected by them may be calculated.

P and Q are corrected by magnetized steel bars, placed in holes bored in the binnacle fore and aft and athwartships. The greater parts of P and Q are corrected by bars 9 inches long and ·4 inch in diameter, and the small remaining parts by bars 9 inches long and ·2 inch in diameter. The latter bars when first placed have a margin of holes above and below, so that they may be readily adjusted on small errors appearing in the compass.

c and k are corrected by a Flinders' bar, or bar of soft iron, 3 inches in diameter and of varying length, placed before or abaft the binnacle. R by one or more vertical magnets in a brass can, placed vertically

underneath the centre of the compass, which may be moved upwards or downwards by a brass chain.[1]

Lieutenant Peichl's System.

Comparing this system with that of Sir W. Thomson, it might at first sight be inferred that they totally differed in principle as well as in form of application, so unlike is one to the other. It is, however, only in the retention of the form of compass hitherto accepted, and in placing the soft iron correctors so near the compass needles as to cause induction in the correctors, that the difference in principle exists. Lieutenant Peichl calls his system a "Universal Corrector."

In this system the gimbal-rings are much larger than in the ordinary compass. From the inner ring a base-plate is suspended by four india-rubber bands. In the centre of this base-plate the compass is fixed, and to the under side of it are screwed metal bearers, carrying fore and aft and athwartships adjustable magnets, intended to correct small changes in the deviation as they appear. From the centre of these bearers there hangs a horizontal metal plate, which can be turned in azimuth and carries four small magnets, arranged like the needles on the Admiralty standard compass-card. If this metal plate be turned in azimuth so as to bring the four parallel magnets upon it into an angle with the keel which can be computed by the relation of coefficients B and C, P, Q, and c may be corrected for one geographical position.

Inside the inner gimbal-ring are two metal discs, placed one above the other, each carrying thirty-two soft iron bars. The inner ends of these bars vary from 1 inch to $1\frac{1}{2}$ inches in distance from the ends of the compass needles and form an ellipse; the outer ends form a circle.

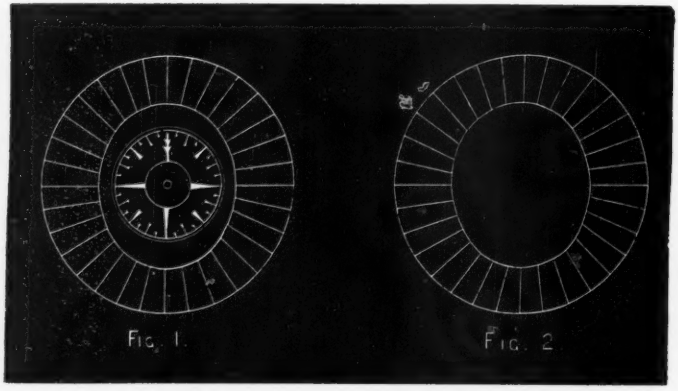


FIG. 1. FIG. 2.

[1] For the excellent plates showing Sir Wm. Thomson's compass and correctors with full letter-press descriptions, see vol. xxi, 1879, and vol. xxiv, 1881, of this Journal.

Fig. 1 shows the compass inside the lower disc and bars, Fig. 2 the upper disc and bars removed for illustration.

In Fig. 1 the bars improve λ and correct $-e$. If the disc in Fig. 2 be placed on that in Fig. 1, the action of the bars on the compass will be as follows:—When the major axes of the two ellipses are at right angles one to the other λ is improved 50 to 80 per cent. If both major axes be in the fore and aft line λ is improved in a less degree, but $-e$ is corrected.

R and k are corrected by an adjustable vertical magnet in the pillar on which the compass urn is fixed.

No Flinders' bar is used.

The magnets used in correcting P, Q, and c are unusually small, being bar-magnets of only 1 inch to 3 inches in length.

Remarks on the two Systems of Correctors.

For ships of the Royal Navy—and it may be also said of all ships—the method of placing the correcting magnets in the binnacle is decidedly preferable to securing them on the deck, and for adjustable magnets Sir W. Thomson's arrangement of holes in the binnacle is simple and can be made amply secure. Lieutenant Peichl's dual system of applying the correcting magnets seems to be a departure from that simplicity which is so desirable, although it is reported to have been well received in the Austro-Hungarian Navy.

Next, as to soft iron correctors. When applied it is an advantage that the correction of the quadrantal deviation should be perfect in all latitudes. In this Sir W. Thomson has fully succeeded. Lieutenant Peichl has rejected this principle, and gives the soft iron the additional work of largely increasing the directive force on the needle. The increase of force thus gained entails the necessity of altering the correctors on change of latitude, introduces a small octantal error, and, unless the gimballing be perfect, a heeling error. There are, however, positions between decks in an armour-plated ship where the directive force is low, and where this arrangement might be adopted for steering compasses with advantage.

Lastly, the Flinders' bar. Although for steering compasses, especially those placed near the ends of vertical iron, this bar would be of great service, yet there are certain objections to placing it near a standard compass:—

1. A computation of the values of c, which the bar is principally intended to correct, for a large number of vessels of every class in the Royal Navy, shows that its value is generally small, and may therefore be conveniently corrected by the adjustable magnets when re-correcting P. k may be corrected by the adjustable vertical magnet when re-correcting R.

2. A vertical bar which is generally behind time in taking up the induced magnetism, due to the ship's new geographical position, might by the shock of firing heavy guns take it up suddenly, and a consequent sudden change in the deviation be caused.

3. As placed in Sir W. Thomson's binnacle, the lower end of the bar comes very near the ends of the fore and aft correcting magnets,

and there is reason to believe that a small *permanent* induction may be caused by them in the bar which is intended to be magnetized by transient induction only.

Instruments for Correcting a Compass without Bearing of Sun, Star, or Terrestrial Object.

The idea of an instrument by means of which a compass may be corrected or error discovered in a corrected compass during fog, or when no bearings of the sun or distant object can be obtained, can hardly fail to be inviting to the careful navigator who knows how necessary constant observations of the deviation are to safe navigation. It is now proposed to inquire how far two recent forms of this instrument answer their purpose.

Sir William Thomson's Deflector.

It is a well known principle that when the directive force acting on the compass is equal for every direction of a ship's head there is no deviation. The directive force on different courses may be measured either by noting the angle of deflection produced by a magnet of a given magnetic power at a constant distance from the compass, or, if an invariable angle of deflection be adopted, by a magnet the magnetic power of which, can be varied at the will of the observer.

The latter method is adopted in this deflector, and the constant angle is 90°.

The deflector consists of a sole-plate supporting brass frames, to which two pairs of small steel bar-magnets are attached. These magnets are adjustable by means of a brass screw shaft. When less magnetic force is required to produce the 90° of deflection, the north poles of the magnets are made to approach the south poles, and when these are drawn apart the magnetic force is increased. A scale of distance is placed between the north and south poles.

To correct a compass.—Bring the ship's head to the north (if under way steer her by an auxiliary compass), place the deflector on the glass top of the compass-bowl and deflect the compass 90°, with the pointer over the E. b. N. point. Note the scale reading. Now bring the ship's head to due south by the compass and repeat the foregoing observations. If the scale readings for the two opposite courses differ, set the deflector to the mean value of them and bring the ship's head either to north or south. The angle of deflection will no longer be 90°, but must be made so by adjusting the fore and aft magnets.

By the same method find the mean scale reading for the east and west points of the compass, and correct the compass by adjusting the athwartship magnets.

Finally, if the deflector reading for the east and west points differs from that for the north and south points, the soft iron globes must be adjusted according to given rules. If the readings are alike, the compass is correct on all points.

If the value of the scale divisions be known, the deviation can be found by observations similar to those described above.

Lieutenant Peichl's "Control Compass."

This instrument is an application of the magnetic dip-needle, principally to the purpose of detecting any small errors which may exist in a corrected compass, but also may be used for observing large deviations.

Theoretically it is based on the well known action of the dip-needle on land—that if its circle be placed in the magnetic meridian the needle shows the least dip. If the circle be moved in azimuth alternately to the east and the west of the magnetic meridian so as to cause the needle to show increased and equal values of dip, the circle will have passed through equal azimuths, the mean of which is magnetic north.

Now, if instead of turning the circle in azimuth it is clamped after being placed in the magnetic meridian, and the ship be turned in azimuth, the whole of the magnetic forces of the ship will remain constant, in respect to the dip-needle, which will now be affected only as before described for a needle on land, with the exception of a small error produced by $-e$ (*see* table). This last source of error being constant, is determined once for all in harbour, and can always be allowed for in setting the control compass.

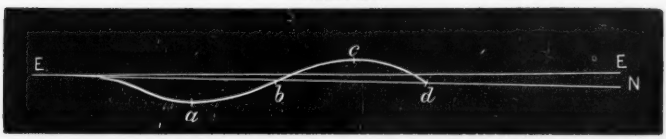
The following is a brief description of the "Control Compass:"—The foot-plate, graduated to degrees, is placed within an urn on a wooden pillar, similar to the standard compass of the Royal Navy. The dip-needles, of which there are a pair pinned together about 0·3 inch apart, carry a small mirror near the axles, which have knife edges and rest in grooves formed in the agate planes. These agate planes are mounted on a gimballed plate, connected with the graduated plate, so as to be used at sea. Two metal arms project from the gimballed plate, one of which carries a graduated ivory scale, the eye-pieces, and two small rotating magnets for bringing the dip-needles into an arbitrary dip—the other arm a vane and thread.

To observe.—Turn the needle casing in azimuth until the dip-needles are in the computed magnetic meridian, look through eye-piece on the mirror, and move the rotating magnets so as to bring the reflected zero of the scale to coincide with a line on the mirror. This will show that the needles are indicating the smallest value of the dip, and the movable circle must be clamped.

Fig. 3 shows an example of the ship's course during the observations, ship starting from a supposed easterly course.

E, E is the course lately steered, E, N the new and correct course by compass to make an easterly course.

FIG. 3.



Starting from E the ship's head is turned to starboard until the

maximum dip (marked by three dots on the scale) is observed at *a*. The ship is now turned to port until *b* is reached, when the minimum dip is observed. Continue the turning to port until the maximum dip is observed at *c*. Bring the ship's head back to the minimum dip at *d*, having noted the direction of the ship's head by standard compass at the instant of the ship arriving at *a*, *b*, *c*, *d*.

Then if the arc read on the compass in turning from *a* to *c* does not exceed 90°, and the mean of the compass courses observed at those points does not differ more than 5° from the given magnetic course, steer on the mean of these compass courses.

If the above limits of 90° and 5° are exceeded there is evidence of large error, and the compass correctors must be adjusted according to given rules,[1] observations about the two cardinal points adjacent to the compass course being sufficient.

Remarks on the Deflector and Control Compass.

Of these two instruments the deflector is intended for use both at sea and in harbour, but only with Sir W. Thomson's compass. There can be no doubt that in skilful hands this deflector fully answers its purpose, and has already been successfully used at sea; but reasons will hereafter be given for thinking that its place is rather as a valuable aid to the practised compass adjuster than the navigator.

The control compass is more especially intended for use at sea, and with any form of compass. The idea of the control compass is both novel and very ingenious, but there are certain practical objections to its use which require notice.

In the first place, the instrument should with its pillar be placed as satisfactorily as regards surrounding iron as the standard compass, a condition difficult of fulfilment. Then the preliminary harbour observations for correction of $-e$ must occupy a long time, and require especial advantages for turning the ship in azimuth.

The necessity for different needles in north and south dip is a complication, and the possibility of unsteadiness of the needle in a sea way has to be considered. Like the "universal corrector," the "control compass" has been reported upon favourably in the Austro-Hungarian Navy.

Instruments for Ascertaining and Correcting the Heeling Error.

Among other appliances for use in connection with Sir W. Thomson's compass is an instrument by which heeling error may be detected with the ship upright, and suitable correction made, when knowing, or being able to estimate λ (see table). By an easy observation on shore (where there is no local disturbance) and a similar one on board, the vertical corrector magnet may readily be adjusted to the required position. Instruments constructed on this principle would be useful with any form of compass.

Concluding Remarks.

From a study of the methods of compass correction just described

[1] See "Instructions for the Use of Lieut. Peichl's Paten Controlling Compass," &c. Trieste, 1880.

in conjunction with the numerical results obtained before and after correction in a large number of different classes of vessels, some conclusions have been drawn which will be now offered for the consideration of those who wish to adopt real improvements, whilst rejecting those of a partial nature often made at the expense of some well-established principle.

Amongst other principles is one all-important, that no system of correctors has yet been devised which should encourage any relaxation in the great care required in providing as good a position as possible, with regard to surrounding iron, for every ship's standard compass.

Simplicity and strength should govern the choice of correctors. Those that are necessary may be shortly described as permanent magnets, either fixed or adjustable, fitted in the binnacle for correcting the semicircular deviation and heeling error, safeguards against their disturbance except by authorized Officers being provided. For the quadrantal deviation, masses of soft iron which may be either globes, cylinders with spherical ends, or thin laminæ. If this correction by soft iron is to be perfect in all latitudes, the compass-card must be constructed for that purpose. In attaining this perfection, however, involving perhaps only 2° to 3° deviation, care must be taken that essentials are not sacrificed, such as sufficient directive force, steadiness at sea, and suitable size.

When a standard compass is properly placed there is little or no need for frequently moving the correcting magnets. The Admiralty Instructions provide that every ship shall be swung on any considerable change of latitude, and once a year, wherever she may be. Such times are here suggested as convenient for re-correcting the compass, if required, the swinging taking place after the correction to ascertain the amount of residual deviation.

No system of correctors enables the navigator to dispense with the habit of daily observations, and record of the deviation. Further, if the ship be occasionally swung at sea, sufficient knowledge of the deviation in different latitudes may be obtained to permit of courses being steered in reasonable safety when sights cannot be taken for several consecutive days. Thus, special instruments for observing the deviation without sights at sea will scarcely be wanted by the careful and intelligent observer.

When a system of observation and subsequent analysis as shown in the previous table is carried out, not only are data provided for the accurate correction of compasses, but also the power of estimating with considerable accuracy certain useful data when they cannot be obtained by observation. With the assistance of these estimated values a ship's compasses may be nearly corrected without moving her from the wooden jetties of the Royal dockyards.

In concluding this paper, it may be remarked that with the increasing speed of modern ships, instruments of precision for navigating them are more than ever necessary. Navigators and all who value life and property at sea can hardly fail to be grateful to those who give their time and talents with a view to making the compass more than heretofore an instrument of precision in iron ships.

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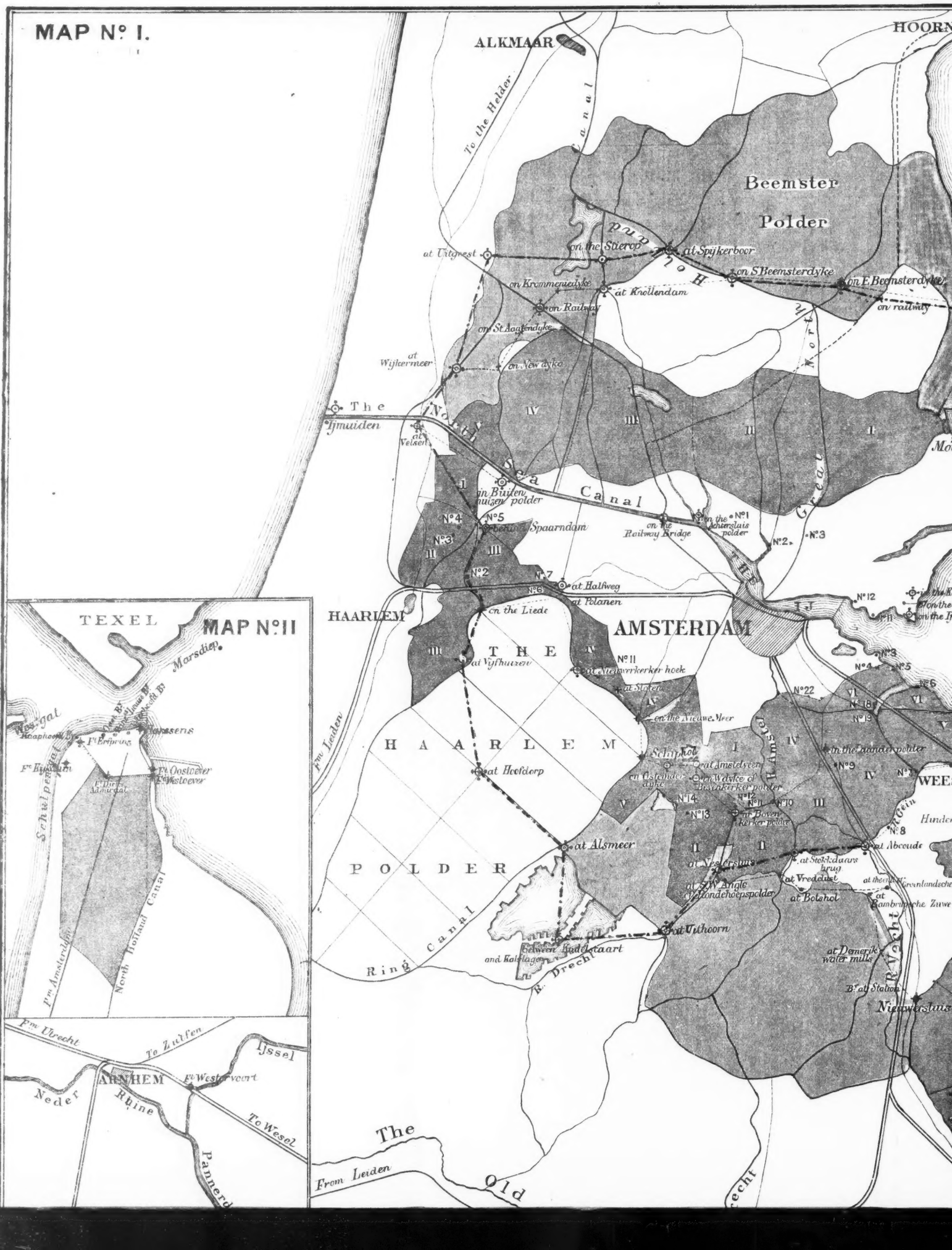
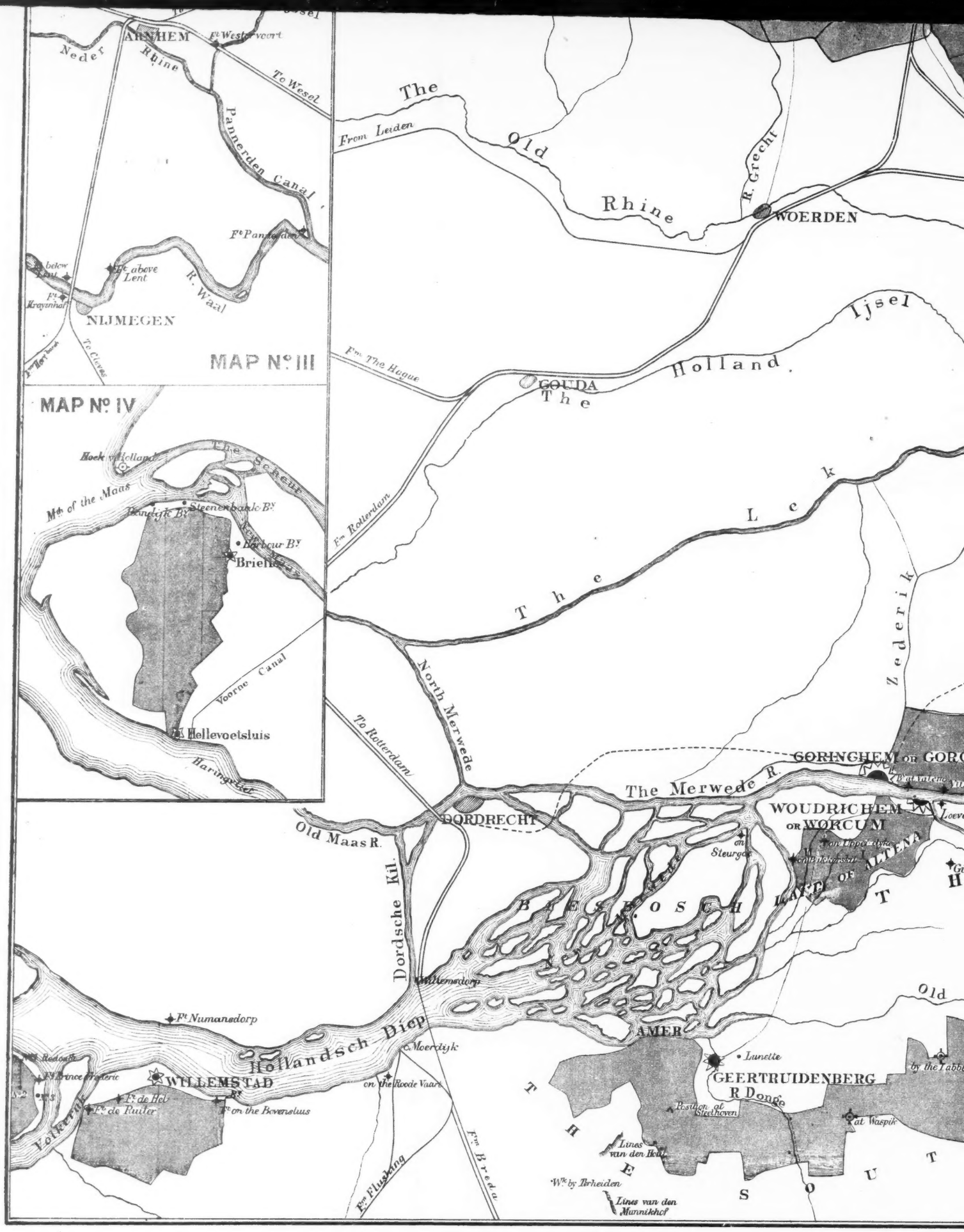
HOLL


MAP Nº I.
ALKMAAR
HOORN
To the Helder
Canal
Beemster
Polder
Purmerlaag
at Uitgrest
on the Sterop
at Spijkerboor
on S. Beemsterdyke
on E. Beemsterdyke
on Krommenieldyke
at Knollendam
on Railway
on St Aagtendyke
on railway
North
Holland
at Wijckermeer
on New dyke
The
Ijmuiden
at Velsen
North Sea Canal
Great
in Buiten huizen polder
on the Railway Bridge
on the Schenkelaars polder
Nº1
Nº2
Nº3
Nº4
Nº5
Nº6
Nº7
Nº8
Nº9
Nº10
Nº11
Nº12
Nº13
Nº14
Nº18
Nº19
Nº22
Spaarndam
at Halfweg
at Polanen
on the Liede
HAARLEM
AMSTERDAM
THE
at Vijfhuizen
at Nieuwerkerker hoek
at Sloten
on the Nieuwe Meer
HAARLEM
POLDER
Fm Leiden
Schinkel
at Amstelveen
on Oosthuider dyke
on Wdvlce of Bovenkerker polder
in Bovenkerker polder
in the Haarlemer polder
Amstel
at Hoofdorp
at Alsmeer
at Nieuwerbrug
at Stolkduarsbrug
at Vredelust
at ZW Angle of Vrondehoepspolder
at Botshol
at Abcoude
at the mouth of Gronlandsche
Kamerlingsche Zuwe
Ring Canal
between Kudelstaart and Kalslagen
at Uithoorn
R. Drecht
at Demerik water mills
Ryn
Nieuwersluis
TEXEL
MAP Nº II
Marsdiep
Nieuwe Diep
Oude Diep
Nieuwe Schild
Oude Schild
Texel
Helder
Schulpengat
Fort Erfprins
Fort Kijkduin
Fort Oostoever
Fort Westoever
Schulpengat
Fm Amsterdam
North Holland Canal
Fm Utrecht
To Zutfen
IJssel
ARNHEM
Fort Westervoort
Nederrijn
Rhine
To Wesel
Pannerden
The
From Leiden
Old

LAND

Plate XV



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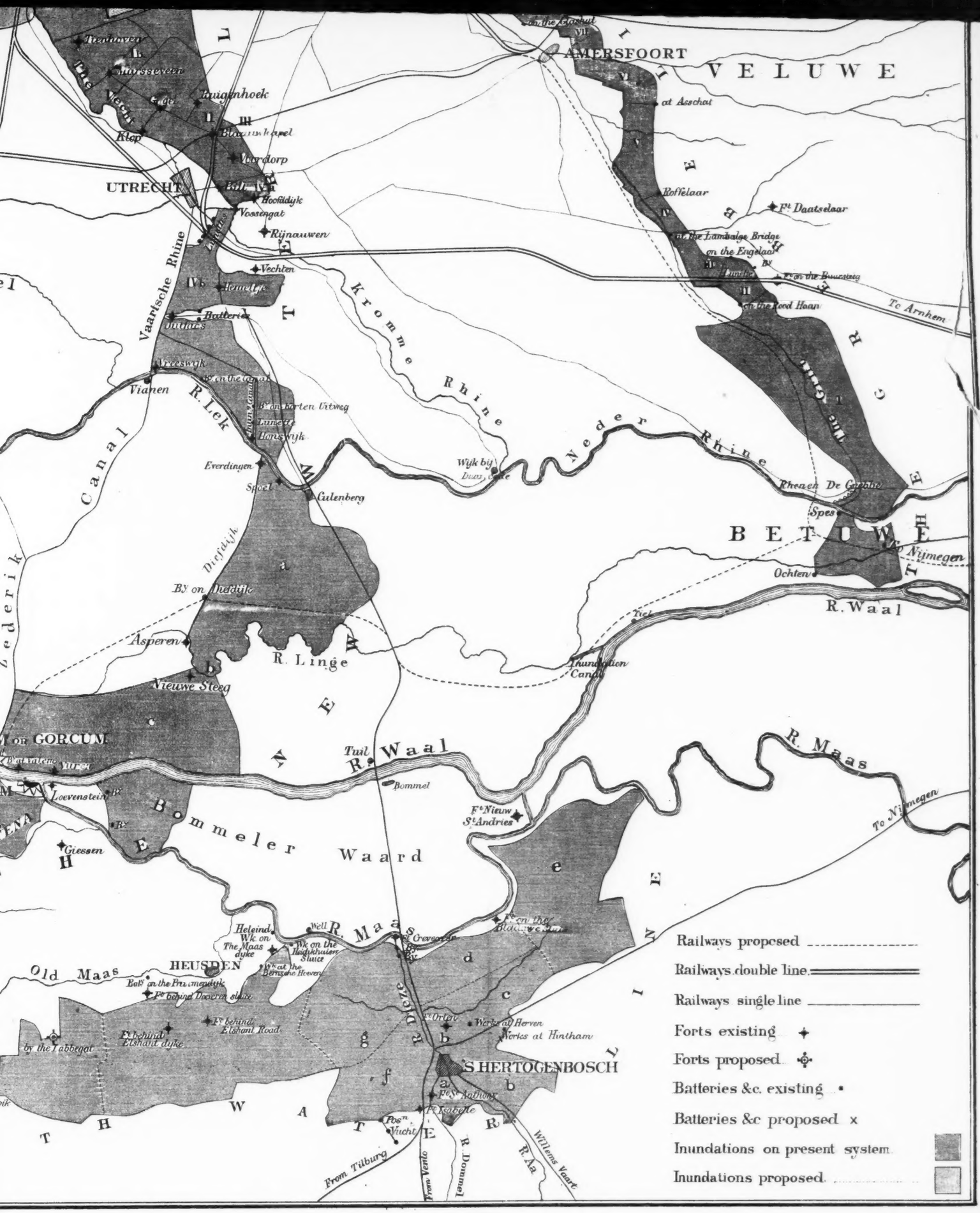

N. L. WALFORD

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HOLLAND AND THE DUTCH.

By Captain N. L. Walford, R.A.

This paper must begin with a protest against the names which head it, since the former implies a confusion between a part and the whole, while the latter is entirely and altogether incorrect.

The country which it is proposed to consider in the following article is called by its inhabitants "Netherland," or "The Netherlands," and contains eleven provinces, of which North and South Holland, though perhaps the richest and most populous, are by no means the largest, and, except by the possession of the political and commercial capitals, have no claim to be considered in any way superior to the remaining nine.

The second error is, however, by far the greater, since, founded on a misapprehension, it is not unlikely to lead to some confusion, for "Dutch," which may be presumed to be a British corruption of "Duitsch," is the name applied by the Netherlanders to those whom we call Germans, from which people they hold themselves to be entirely distinct. It is true that there are many points of similarity between the two languages, yet there are also such essential differences, that no one who has heard both spoken could fail to distinguish between them, even though on looking at them, as written, we must acknowledge that they are obviously of one family.

If there be a quality which more than any other has characterized, and does characterize the Dutch, it is their sturdy and almost contemptuous independence in thought and action: small in number and confined in a narrow territory, this remarkable people have, under various vicissitudes and through several centuries, preserved a distinct individuality; and if it be admitted that a national character, a national language, and national customs go far to create a people, we must acknowledge that the Dutch are a nation, and should be relieved from the name with which, in our ignorance, we have dubbed them.

The Dutch have in turn won their land from the sea, and freed it from alien masters; and though their country has been held temporarily by Spain, Germany, and France, have never shared the nationality of their rulers, have never adopted their language, and have never failed to seize the earliest possible opportunity to rise against the foreigners, and to reassume an independent existence.

One point, though perhaps a small one, well marks the particular indivi-

duality of the nation. In other languages, nearly all scientific terms, including even those in familiar use, are constructed with the help of Latin or Greek, changed according to the genius of each people into some form of bastard *patois;* but the Dutch, while second to none in their intellectual culture, reject the foreign name, and, constructing its equivalent in their own language, make the word their own as well as the thing.

Enough has probably been said to show that we have no more reason to call this people "Dutch," and their country "Holland," than they would have should they call us "Saxons," and describe England as "Kent."

It is proposed to divide this paper under the following heads :—

I. The Military Geography of Holland.
II. The Military History of Holland.
III. The Army, Finances, &c., of Holland.
IV. The Politico-Military Position of Holland.
V. The General Plan of the existing and proposed Defences of Holland.
VI. The details of the various Defences and Inundations.

I.—The Military Geography of Holland.

This country may, for the purposes of strategy, be compared to a triangle, one side of which is formed by the sea, while the others follow the lines of her southern and eastern frontiers. She is liable to invasion on any or all of these sides, since her boundaries have no natural defences, unless we regard the sea as such, while the nature of the country itself, proverbially flat and low, forbids the existence of any ground such as would afford a position in the ordinary sense of the word.

But formed by the water, conquered from the water, it is in her waterways that Holland finds at once her means of communication in peace, and of defence in war. Napoleon, in 1810, justified the absorption of Holland into the French Empire by the fact that this land was formed by the alluvial deposits of French rivers ; and it is, in truth, the delta of the Rhine and of the Meuse or Maas.

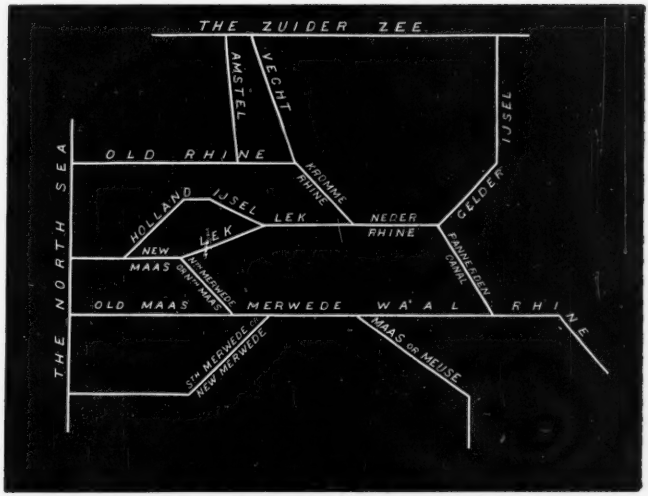
Since it will be necessary in the course of this paper constantly to refer to these rivers and their effluents, it will be well to commence the subject by an examination of their course, more especially as we shall find that a river which divides, or which unites with another, almost invariably changes its name.

The Rhine, shortly after crossing the frontier of Holland, divides into—

A. The Pannerden Canal.
I. The Waal.

A. The Pannerden Canal, at Arnhem, divides into—
B. The Gelder Ijsel, which runs north by Zutfen and Zwolle into the Zuider Zee at Kampen.
C. The Neder-Rhine ; this, at Wijk-bij-Duurstede, divides into the
D. Kromme (or winding) Rhine.
E. The Lek.
D. At Utrecht, the Kromme Rhine divides into—
F. The Old Rhine, which flows into the North Sea at Katwijk, after sending the Amstel to the north into the Zuider Zee.
G. The Vecht, which runs into the Zuider Zee at Muiden.
E. The Lek, parting with the Holland Ijsel, itself runs into the North Merwede or North Maas.

I. The Waal, after receiving the Maas, or Meuse, at Woudrichem or Worcum, is called the Merwede. Near Dordrecht the Merwede divides into—



Principal Mouths of the Rhine and Maas.

II. The North Merwede or North Maas.
III. The Old Maas, which runs into the North Sea.
IV. The South or New Merwede, which runs through the Hollandsch Diep, and the Haringvliet into the North Sea.
II. The North Merwede, or Maas, after receiving (E.) the Lek, is called the New Maas, and as such receives the Holland Ijsel, after which it runs into the North Sea.

The smaller waters, such as the Vaartsche (or canalized) Rhine, the Linge, and a little river called also the Old Maas, have been omitted in the plan, but will be found in the map.

Putting aside for the moment the question of the defence of the coasts, since that portion of the frontier resembles in great degree the sea-line of other countries, let us consider the defensive character of the southern and eastern sides of the triangle.

1. *The Southern Line of Defence.*

This is formed first by the course of the Maas, which will, when the breadth of the river is made constant by an intended system of dykes, have between Crèvecœur and Loevenstein a width of from 185 to 550 yards, according as the river may be low or in flood. It is crossed at Crèvecœur by a railway bridge 780 yards in length, and sufficiently wide for a double line; at this point there is also a bridge of boats. There are also many flying bridges and ferries.

The second line is formed by the Waal and the Merwede. The former varies in width from 270 to 1,070 yards, but in time of flood is in places 3,000 yards wide. There is a railway bridge at Bommel, broad enough for a double line, and 950 yards in length, and there are further, at many points, flying bridges and ferries. The Merwede has a width of from 550 to 1,300 yards, and has no bridges, though ferries are numerous along its course.

It may be well, before passing to the third line, to say that the railway

bridge over the Hollandsch Diep near Moerdijk is for a single line, and has a length of 2,568 yards, including the piers on each bank: the actual bridge (iron lattice) is in two parts, a swing bridge of 70 yards, and a permanent bridge of 1,600 yards in length.

The third line is formed by the Lek, a river of from 180 to 500 yards in width. It is crossed at Culenberg by a railway bridge, 720 yards in length, of which the pier in the river is provided with a chamber for a mine. There is a boat-bridge at Vreeswijk, and numerous flying bridges and ferries exist along the river.

The general character of the country is the same throughout this part of Holland. It consists of highly cultivated land, of which a great part lies lower than the canals and rivers, the latter of which are confined by strong dykes, while the former, in many cases, run parallel to the roads, on the dykes which intervene between the "polders."

And here it may be well to describe what is meant by this word "polder," since almost the whole of Western Holland is made up of land so saved. A "polder" is the bed of a marsh or lake, which has been, and is daily, drained of water, and is thus made available for cultivation. The process is as follows:—A dyke, on which is a canal, is first made round the spot or district selected, and into this canal the water is pumped by wind-mills or steam-engines, until at length the surface is comparatively dry; ditches are then made in the polder, and from these again the water is pumped into the canal, until the land is suited for the purposes of agriculture. In some cases the original marsh lies so low that it is not possible to raise the water at once to such a height as will allow it to run off. In this event, it is pumped from one to another of various canals[1] of gradually increasing elevation, until the desired height is attained.

The general appearance of a polder is that of a large field, containing frequently 300 or 400 acres, surrounded by a green bank, in some cases 20 or 30 feet in height, and intersected by numberless ditches, from 3 to 10 yards wide, which cross each other usually at right angles. It would thus be exceedingly difficult for troops to move over such a district, even were it not inundated, while the dykes round the polders entirely prevent any view being obtained of the surrounding country. The roads run, as before mentioned, along the tops of the enclosing dykes, and it is almost impossible for any one, not a native of the country, to cross a polder, or in any way to make a short cut. The roads are of various kinds: (*a*) The "straatweg," which is paved either with stone or with bricks (or rather tiles) set on edge; this is an excellent road when in repair, but exceedingly trying to the feet, and is generally about 12 to 15 feet in width. (*b*) Macadamized roads, of which there are few, since in most parts of the country there is no stone. (*c*) "Grintwegen" or gravel roads, which are fairly good in fine weather, but would soon be destroyed by the passage of artillery. (*d*) "Zandwegen" and "Klei-wegen," which are merely tracks in sand or clay; these last are, as a rule, the only roads available between the dykes. Roads are, however, comparatively little used in Holland, the greater part of the passenger traffic being carried on by rail or tramway, while goods are principally transported by the canals.

Enough has probably been said to show that the defence of this part of Holland is easy, owing to the impassable nature of the country, and to the fact that the roads, by which alone an army can advance, running as they do along the tops of the dykes, are entirely commanded by any works which may be posted on the latter, and are, especially should the intervening country be inundated, defiles in the strictest sense of the term.

[1] It has been found by experience that water can be most economically raised, by pumping it to a height of only 1 metre for each engine. There is a polder near Alkmaar, where the water is raised into four canals in succession before it runs off.

2. *The Eastern Lines of Defence.*

Of these the first is formed by the Gelder Ijsel from Kampen to Arnhem. This river varies in width from 70 to 320 yards, but when in flood, has a breadth of from 1,100 to 2,200 yards. Its depth varies considerably, but in dry seasons it is fordable at at least three points, namely, at Dieren, between Deventer and Olst, and at a point below the latter place. It is crossed by three railway bridges :—

(*a*) At Westervoort (near Arnhem), by a bridge of 300 yards in length, carrying two lines of rail.

(*b*) At Zutfen, a lattice-bridge for a single line of 400 yards length between the embankments. This bridge has a carriage and a foot-way in addition to the railway. One of the piers contains a chamber for a mine.

(*c*) Near Zwolle, a bridge over 500 yards in length, carrying a single line, but wide enough for a second. Under one of the piers of this bridge also is a chamber for a mine.

There are boat-bridges at Westervoort, Doesburg, and Deventer, while at Kampen there is a permanent iron bridge for carriages and foot passengers. There are numerous ferries.

The ground to the east side of the Ijsel is lower than that on the west, and the river is dyked along its right bank except about Deventer, but on the left bank such protection is needed only in parts.

The second line is formed by the river Eem and the Grift, which, rising near each other, flow, the former northwards into the Zuider Zee, the latter to the south into the Neder-Rhine : they are connected by a brook which bears the name of the Lunter.

The Eem has a width of about 60 yards, and is crossed by a railway bridge near Amersfoort.

The breadth of the Grift is 17 or 18 yards only.

The country between the first and second lines is, especially in the southern portion, high, dry, and sandy, and along the line of rail from Utrecht to Arnhem very much resembles the ground about Aldershot, being covered with heather and pine woods.

The roads are for the most part bad, and there is but little cultivation.

The third line is formed by the Kromme Rhine, the Vaartsche Rhine, and the Vecht, and this has been for three centuries the main line of the Dutch defence.

The Kromme Rhine extends from Wijk-bij-Duurstede to Utrecht, about 12 miles, and is shut in along its whole length by dykes. Its breadth is about 15 yards, and it is supplied with sluices for the purpose of military inundations. It is crossed by a great number of bridges.

The Vaartsche (or canalized) Rhine is a portion of the canal which runs from Amsterdam by Weesp and Utrecht to Vreeswijk. It is about 5 miles in length, and has a breadth of about 30 yards.

Below Utrecht there is a bridge behind Fort Jutfaas.

The Vecht runs from Utrecht to Muiden, about 16 miles, and at the latter point enters the Zuider Zee. It has a width of 20 yards as a minimum, and is crossed by a great number of bridges. At Nieuwersluis there is a dam and sluice for military inundations.

The country to the west of the second line, which at first resembles that to the east of it, changes its character on approaching the third line, and becomes so low and wet that it is little more than a collection of polders, of the same character as those of which mention has already been made, the roads, as before, running along dykes, while the intervening ground may be easily inundated.

It will be evident from even the cursory description which can be given in an article such as the present, that the eastern lines of defence are far weaker than the southern, since all the rivers in the former are small, and the intervening ground offers no such facilities for defence as we find in the latter. On the third line only can water be used to any great extent to assist the defence, and even in this the higher ground about Utrecht raises that point above inundation level, and thus weakens the very centre of the line.

In the case of an invasion from the sea, the enemy, after landing, would probably endeavour to force his way along one or more of the canals which lead into the heart of the country, and we shall find that the coast defences are so placed as to guard all or nearly all of these means of access.

From whatever point invasion may come, the centre of the Dutch system of defence is at the commercial capital, Amsterdam, which it is intended to hold as a *rêduit*, or last retreat for the army; but since it is proposed to examine these defences in detail, it may be sufficient for the present to mention that the country round Amsterdam lies lower, and is more easily inundated (and therefore defended) than any other part of the kingdom.

II.—The Military History of Holland.

Having, in as few words as possible, endeavoured to give a general idea of the geographical character of this country, it may be interesting to describe in what manner the several invasions of the Netherlands have succeeded or failed.

Holland has been invaded: by Spain in 1605, 1606, and 1629; by France in 1672, 1793, and 1794; and by Prussia in 1787. We may omit the efforts of England on the Helder in 1799, and on the island of Walcheren in 1809, and need give but a few words to the collapse of the French rule in 1813 before an advance of the Russians and Prussians, which took place after the battle of Leipsic.

1. *The Spanish Invasions.*

In 1543, the Emperor Charles V, by right of his mother, became possessed of the whole of the Netherlands, and from him they passed, under his will, to Philip II, King of Spain and the Indies, his son.

This monarch, whose principle in life appears to have been to secure the safety of his own soul by the destruction of the bodies of millions of his subjects, pressed on by intolerant zeal, endeavoured to force upon Protestant Holland the ritual and the Inquisition of Rome. Having failed to convince, he determined to coerce the Dutch, but the latter, after meeting eloquence with eloquence and logic with argument, set sword against sword and water against fire, and under William the Silent, Prince of Orange, made stern head against all weapons, spiritual and temporal. This Prince having been assassinated in 1584, his place was taken by his son, Maurice of Nassau.

(*a*) In 1605, Spain, irritated at the loss of prestige consequent upon the continued resistance of the small republic, sent an army under Spinola against the Dutch, with orders to subjugate the entire country. Spinola, one of the best Generals of his time, aware of the great natural strength of the southern front of defence, resolved to turn it and attack the eastern front.

For this purpose he divided his army into two parts, with one of which he occupied Flanders, with the view of holding Maurice of Nassau, while the other passed the Maas between Grave and Venlo, the Rhine at Emmerick, and overran Gelderland and Overijssel. But Maurice, recognizing the decisive point of the Spanish strategy, broke away from his position, and, attacking the Spaniards, drove them across the Rhine.

(*b*) *Invasion of* 1606.—In this year Spinola invaded Holland with two armies, of which that which he himself commanded was to cross the Gelder

Ijsel, and to move through the Veluwe ; while the second, under the Comte de Bucquoy, should cross the Waal above Nijmegen, and traversing the Betuwe, join him under the walls of Utrecht. Continued rains, which ruined the roads and made the country impassable, so delayed the march of Spinola, that Maurice was able to arrive first at the Ijsel, and to organize the defence of that river, and the former was compelled to limit his efforts to the observation of the enemy ; while de Bucquoy failed altogether in his endeavour to cross the Waal.

Maurice, in the meantime, lined the banks of the Ijsel and the Waal with a chain of redoubts, and placed armed boats upon each of these rivers. He thus succeeded in repulsing every attack of the Spaniards, who at length abandoned their scheme of invasion, and concluded a truce with the States.

(*c*) *Invasion of* 1629.—In this year Holland was attacked by a combined army of Spaniards and of troops of the German Empire. The Dutch Army, occupied in great part in the defence of Hertogenbosch, left their eastern lines open to the invaders, who forced the Ijsel, overran the Veluwe, and, having taken Amersfoort, were first stopped at Naarden on the left flank of the third defensive line. They were here checked by the fortifications and inundations, which occupied almost the same position as the existing water-line, and were eventually, owing partly to events in Germany, partly to the want of supplies, forced to evacuate the country in haste.

The war with Spain, which began with the battle of Heiligerlee in 1568, found its end at the Peace of Westphalia, in 1647, when the Independence of Holland was fully conceded.

2. *The Invasion of* 1672.

France and England having declared war with Holland, Louis XIV in person took command of an army of 120,000 men, and masking Maastricht, passed the Maas at Maaseyck ; marching northward he proposed to join the Bishops of Munster and Cologne, who held the right bank of the Ijsel. But a remarkable drought had rendered the Neder-Rhine fordable, and, changing his plans, Louis forced the passage of this river, and thus turned the line of defence of the Ijsel. All the strong places of Gelderland fell at once, and the army of the States retired on Amsterdam.

The country round the capital was inundated, and every approach being defended by works, while armed boats and floating batteries swarmed on all the canals, Louis abandoned the attack as impossible, and, being influenced by the news of further complications with Germany, fell back from his position and retired into France.

3. *The Invasion of* 1787.

William V, the then Stadhouder,[1] married, in 1766, the niece of Frederick the Great of Prussia, and a quarrel having arisen between the people of Holland and their ruler, the latter was driven from Amsterdam. The Princess, while travelling without an escort to the Hague, was insulted by an Officer of the States Army, who, it is said, forced his way into her chamber with a drawn sword. Irritated at this affront, the King of Prussia ordered the advance of 26,000 men, under the Duke of Brunswick, into the disaffected provinces.

The Stadhouder had but 4,000 or 5,000 men, and Gelderland alone remained faithful to him, but this fidelity was of great service to the Prussians, since it carried with it the possession by William of the passages of the Gelder Ijsel, the first line of defence. The second line also, that of the Grebbe,[2] could not be defended by the States, owing to the fact that the inhabitants of Amersfoort favoured the House of Orange.

[1] This is at least Dutch, while "Stadtholder" is not even English.

[2] The line formed along the Eem and the Grift is called the Grebbe line.

There remained yet the third line, from the Zuider Zee, by Utrecht, to Gorinchem or Gorcum: this was held by the national army of 20,000 men, assisted by about 20,000 militia, the mode of occupation selected being that of placing garrisons in the various works which covered the approaches between the inundations, reserving about 10,000 men to defend the less easily inundated ground about Utrecht.

Reconnaissances especially directed on Naarden and Utrecht deceived the Dutch leader, Count Salm, who expected a regular siege of one or both of these places, while the Prussian Army, which crossed the frontier on the 13th September, with the intention of breaking through the line at Vreeswijk, where the Vaartsche Rhine joins the Lek, attained its object, on the arrival of its left wing at Gorcum, by the surrender of that fortress after a mere semblance of resistance.

The column which moved on Vreeswijk was unopposed, and, Uitermeer and Nieuwersluis having been carried by a most gallant *coup de main*, Utrecht surrendered on the 17th, and Naarden on the 27th, by which latter date the whole of the line was in the hands of the Prussians.

There remained still Amsterdam, surrounded by a girdle of inundations, but held by only six regular battalions, who were, however, assisted by a numerous militia.

An armistice of four days, demanded by the Dutch, was employed by the Prussians in collecting boats on the Haarlem Lake (now drained), and at daybreak on the 1st of October, the latter, passing the lake, landed one body of troops at Halfweg, and another in rear of Amstelveen, where the Dutch flank rested on the lake. After a sharp but short fight, both points were carried, and on the 9th of October the city surrendered at discretion. The campaign thus lasted only twenty-eight days, and their success was obtained by the Prussians with very inconsiderable loss.

4. *The Invasion of* 1793.

Shortly after the execution of Louis XVI, the National Convention of France, anticipating the action of those Powers, declared war upon England, Spain, and Holland, and two French Armies, one of 20,000 men, under Dumouriez, and the other of about the same strength under Miranda, invaded the latter country.

Miranda's share in this campaign may be stated in few words, for, having laid siege to Maastricht on the 20th February, he was driven thence by the Imperialists under the Archduke Charles, and was during the first week of March forced back into Belgium.

Dumouriez, advancing from Antwerp, captured Breda on the 17th of February, Geertruidenberg shortly after, and next undertook the siege of Willemstad. He proposed, after the latter fortress should have surrendered, to cross the Biesbosch, and to march directly on Amsterdam; but the siege of Willemstad was raised owing to the gallant action of Lieutenant Western, who was in command of three British gunboats, while the Dutch concentrated their troops in front of the French, and, having been joined by a British force under the Duke of York, were in sufficient strength to resist the passage.

The number of boats also which could be made available was insufficient for the transit, and Dumouriez himself having been hastily recalled to repair the disasters of Miranda, the French abandoned the attempt at Holland, and fell back on Antwerp.

5. *The Invasion of* 1794.

The Allied Army having, after the Battle of Fleurus, retired to the line of the Dyk, was pressed back by the French under Pichegru, who in 1794 determined to repeat the attempt of the preceding year.

The French had in the Netherlands a force of about 84,000 men; the British numbered about 35,000, and the Dutch about 15,000. The Austrians, fearing for Coblenz and Cologne, retired by way of Maastricht across the Maas, and were followed by a French army under Jourdain. This defection compelled the retreat of the Duke of York, who, on the 22nd of July, had retired on Rozendaal, between Breda and Bergen-op-zoom.

Pichegru, by order of the Convention, delayed his march until the four French fortresses, Quesnoy, Landrecy, Condé, and Valenciennes, had been recaptured from the Allies, but he advanced on the 4th September, and carried the position of Boxtel[1] on the 14th, after which event the Anglo-Dutch Army retired behind the Maas.

Hertogenbosch surrendered on the 10th of October, and Fort Crèvecœur having previously fallen, the Duke of York fell back behind the Waal, with his headquarters at Nijmegen, while detachments of the British troops were posted along the river as far as Gorcum. Taking advantage of the length and consequent weakness of this line, Pichegru attacked the centre, and, having obtained some slight success, drove back the Duke on Arnhem.

The Dutch troops now drew back to Grebbe on the Neder-Rhine, Venlo and Nijmegen were captured early in November, and in the beginning of December the Duke of York returned to England.

Pichegru having been compelled by ill-health to relinquish the command to Moreau, the latter attacked Bommel, but was repulsed, upon which he sent his troops into winter quarters.

On the return of Pichegru towards the end of December, he, realizing how great assistance would be given by the intense frost of that winter to the efforts of his troops to cross the inundations, determined to continue the campaign. He renewed the attempt on Bommel, forced the passage of the Waal, and drove the Dutch Army to Gorcum. The British, who seem, after the departure of their General, to have become more active, attacked the French in their new position, and forced them to recross the Waal; but Pichegru, on the 2nd of January, 1795, again passed that river at Tuil, and having on the 4th repulsed an attack, succeeded in maintaining his position.

On the 10th January, a considerable force of the French crossed the Waal above Nijmegen on the left of the Allies, while another body struck at the point of junction of the Austrians[2] and British. As the result of these movements, the British Army, under Abercrombie, crossed the Rhine at Rhenen, retired through Gelderland and Overijssel into Germany, and was embarked at Bremen for England on the 12th April, 1795, having suffered terrible hardships in its retreat through a bleak and sterile country. Gorinchem or Gorcum and Utrecht fell on the 12th of January, and on the 20th Pichegru entered Amsterdam, his success being finally due to a revolutionary movement excited by some "exiles" of 1787, and by other republicans. After this conquest the new "Republic of Batavia" preserved a semblance of independence, rendered dubious, however, by the undesired present of an army of 36,000 men, who were "to protect it against the attempts which the Prince of Orange might make to endanger its liberty." The Head of the State was styled "Grand Pensionary," and his rule endured until 1805, when Louis Buonaparte was created King of Holland. This Prince reigned until 1810, when Holland was finally annexed to the Empire.

In 1813, the Russian and Prussian Armies, under Winzingerode and Bülow, entered Holland from Germany, having been detached by Bernadotte after the battle of Leipsic. Encouraged by their arrival, the Dutch everywhere rose against the French; on the 23rd of December Winzingerode entered

[1] In this affair Wellington was for the first time under fire.

[2] These had been sent from the Rhine at the request of the Duke of York.

Amsterdam, the independence of the country was proclaimed, and the Prince of Orange recalled.[1]

The possession of Amsterdam by the Russians turned the flank of the French position at Utrecht, and the latter fell back on Gorcum. Willemstad and Breda shortly capitulated, as did also Geertruidenberg, and the French were by the end of the year in possession only of a portion of Zealand, and of the fortress of Bergen-op-zoom, which in 1814 was the scene of the gallant but unsuccessful attempt of Sir Thomas Graham.

The Dutch under the Prince of Orange took a prominent part in the battle of Waterloo; and at the Congress of Vienna, Holland and Belgium, united into a kingdom, were given to the Dutch leader, who ruled under the title of William I.

But the Dutch and the Belgians differ essentially in religion, in language, and in temperament, and it was soon found that an artificial union was impossible between two peoples so dissimilar. The quarrels and disagreements between them culminated in the Revolution of 1830, which, though at first kept under by the action of the Dutch troops, was encouraged by France, and eventually received the assistance of a French Army.

After a struggle, short indeed, but memorable for the defence of the citadel of Antwerp by General Chassé, Belgium was separated from Holland, and erected into an independent kingdom.

Holland has of late years taken no part in European complications, but in 1870, with the view of protecting her neutrality, mobilized the greater part of her army, a proceeding which led to the discovery of many imperfections and faults in her military system.

III.—The Army, Finances, &c., of Holland.

The extreme length of Holland from north-east to south-west is about 190 miles, and its breadth from east to west 123 miles; the area of the kingdom is 12,680 square miles, excluding Luxemburg, of which the King of Holland is the Grand Duke.

The population of the Netherlands amounted on January 1st, 1880, to 4,060,578 souls, of whom two-fifths were Roman Catholics and 70,000 Jews, the remainder being Protestants.

The national debt in 1881 amounted to about 83,000,000*l.*; the condition of the finances can be best understood from the following tables:—[2]

	Expenditure for 1880.	£
1.	King's Civil List	62,500
2.	State Councils, &c.	51,324
3.	Foreign Office	53,074
4.	Justice	370,633
5.	Home Office	623,572
6.	Admiralty	1,050,962
7.	National Debt (interest)	2,371,389
	Finance Department	1,515,191
8.	War Department	1,716,666
9.	Department of Canals, &c.	1,647,668
10.	Colonial Department	120,085
11.	Unforeseen expenses	4,166
	Total	£9,587,230

These expenses include a sum of 60,000*l.* devoted to the gradual extinction of the national debt.

[1] The last Stadhouder had died in exile in 1806.

[2] Calculated at the rate of 12 gulden to 1*l.*

Revenue for 1880.

	£
1. Taxes on land, income, capital, &c.	2,037,620
2. Excise	3,231,250
3. Indirect taxes	1,871,050
4. Stamp duties	384,253
5. Duty on gold and silver	28,000
6. Domains....	135,416
7. Post Office	312,500
8. Telegraphs	70,500
9. State Lotteries	35,833
10. Fisheries, &c.	12,166
11. Pilotage	75,000
12. Dividend from State Railways	131,000
13. Various receipts	667,265
Total	£8,991,853

Total Expenditure	£9,587,230
Total Revenue	£8,991,853
Deficit	£595,377

This deficit is, however, lessened by the receipts from the Colonies, which the Dutch have succeeded, on some principle peculiar to themselves, in making a source of income to the mother country; the receipts from this source were in 1878 only about 200,000*l.*, but in 1875 they were nearly 2,000,000*l.*, and accordingly we find that the latter was the last year in which there was a surplus to the Budget.

For the Excise are taxed sugar, wine, spirits, salt, soap (!), beer, vinegar, and butcher's meat, while, strange to say, the taxation of tobacco, carriages, lace, servants, and other luxuries does not appear to recommend itself to Dutch statesmen.

The Army of the Netherlands.

The Dutch military system is original and peculiar, and should be of interest to us, since Holland suffers from the same military difficulties as does England, namely, the want of recruits, and the necessity to supply troops to her very disproportionately large external possessions. If we consider the latter, we find that the Dutch, unlike ourselves, devote two separate and distinct forces, one to Home, the other to Colonial service; but there is reason to believe that, were it not for the fear of still further diminishing the numbers of voluntary recruits, they would be only too glad to employ their army on universal service.

Of the colonial army it may be sufficient to say that it consists of—

(1) The East Indian Army of about 30,000 men, of whom about 13,000 are Europeans.

(2) The West Indian detachment of about 600 men.

Recruits for both forces are obtained by voluntary enlistment, for which the maximum bounties are as follows:—

East Indies—	£	*s.*	*d.*
A Netherlander, 4 years' engagement	16	13	4
„ 6 „ „	25	0	0
A Foreigner, 4 „ „	8	6	8
„ 6 „ „	16	13	4

West Indies—	£	s.	d.
Army recruit, 6 years' engagement	25	0	0

The East Indian Army is stationed at various point in Sumatra, Java, Borneo, and the Moluccas, while the West Indian troops occupy Surinam and Curaçoa. In the East Indies there is, in addition to the numbers given above, an auxiliary force of about 10,000 men.

Although the Constitution of Holland fully recognizes that it is the duty of every man to bear arms, in case of necessity, in the service of his country, yet the spirit of the Dutch people is so strongly opposed to military service, that this principle has never been worked out to its logical ending, and the home army of Holland is therefore in theory supplied by voluntary enlistment.

In practice this system is a complete failure, in spite of the high bounties given to recruits, which vary, as a maximum, between £5 and £10. In proof of this statement it may be mentioned that the total number of men[1] voluntarily enlisted was on the 1st July, 1880, as follows:

Infantry	810
Cavalry	1,433
Artillery	824
Engineers	267
Total	3,334

A voluntary recruit enlists for not less than six or more than twelve years. Non-commissioned officers and soldiers may at any time re-engage for any number of years not exceeding twelve.

Recruits must be between the ages of eighteen and thirty-six years, unless they have served already, in which case they may be taken up to forty.

No recruit is accepted, except as a drummer or bugler, who is less than 5 feet 1½ inches in height.

The number of voluntary recruits being so exceedingly small, it is necessary to fill up the army from the national militia, and it would, in point of fact, be simpler to say at once, that Holland has no *army*, in the ordinary sense of the word, but possesses only such cadres as enable the War Department to pass yearly a certain number of militiamen through a short course of military training.

It was originally intended that this militia contingent should be made up, partly of volunteers, and partly by conscription, but it has been found in practice that no volunteers ever come forward, and the whole is therefore supplied on the latter system.

The annual contingent under the law of 19th August, 1861, was fixed at 11,000 men, but a new law was introduced in September, 1881, which raises this number to 12,600. In either case we must deduct 600, as the number of recruits who are sent to the navy.

A militiaman is liable for service during five years:[2] therefore under the new law the number in the army will be about 60,000, in the navy, 3,000.

The militia contingent is supplied by ballot among the young men who enter their twentieth year on the 1st of each January, and these are registered, for this purpose, during the preceding year.

Every man is liable to service:—

(1) If his father, or if he be dead, his mother, or if both be dead, his guardian is a native of Holland; or

(2) If he has no parents or guardians.

The following are exempted from service:—

[1] Not including non-commissioned officers.

[2] In time of peace. *See post.*

(*a*) If of less height than 5 feet 1 inch.
(*b*) If medically unfit for service.
(*c*) An only son (if legitimate).
(*d*) Who is already in Government employ.
(*e*) Who is a midshipman or cadet.
(*f*) Who was trained in a Government school as a surgeon or veterinary surgeon.
(*g*) Who has served five years as a volunteer, in a lower rank than that of an Officer, in the navy or army, at home or abroad.
(*h*) Whose brother or half-brother is serving or has served (in a lower rank than that of an Officer), either in the militia, or as a volunteer in the navy or army at home and abroad.

If the number of sons in a family be even, half, if odd, the smaller half, are liable to serve.

The clergy and students in divinity, and others under special circumstances, may, on application, obtain exemption from actual service for one year; this exemption may, on further application, be annually renewed.

Men who have been dismissed from the army or navy, or who have received any degrading punishment, are not allowed to serve.

The total number of those liable to service was, in 1879, 33,262, of whom—

1,357	were	under the standard of height,	
2,708	were	exempted as medically unfit,	
4,639	„	„	as only sons,
10,257	„	„	on account of brothers' service,
Total 18,961			

leaving a residue of 14,301, of whom 10,894 were taken, out of which 600 for the navy.

The full contingent was 11,000, but 106 deserted. It is interesting to note that 2,096 applied to be posted to the navy, while 1 (!) volunteered for the army, showing plainly which of the two is the popular service.

Substitutes are permitted, and are divided into two classes, viz., "number-changers" and "place-changers."

The substitute provided by place-changing (*plaats-vervanger*), must be a native, fit for service, at least 5 feet 1½ inches in height, between twenty-one and thirty-five years of age, and of good moral character. He must also be unmarried or a childless widower, and have further fulfilled his own service in the militia. If he has served in the army or navy, and can show a certificate of good character, he is accepted up to the age of forty years.

The substitute by number-changing[1] (*nummer-verwisselaar*) must belong to the same levy of the same province as the conscript whose place he takes, and must be fit for service.

The conscript who changes numbers with a substitute is entirely free, but he who changes places is, should his substitute desert, liable during one year to find a new substitute, or to serve himself.

The ballot for the militia is held annually between the 7th February and the 7th March at such places as the King's Commissioners may appoint, and each "commune" contributes its quota according to the number of its inhabitants, and the number of men which it has already supplied to the Militia; the contingent to be furnished by each province is officially published by the King in the "Staats blad," or Gazette, and that for each commune by the provincial states, in the local Gazette.

[1] The substitute who has drawn a good number in the ballot exchanges it for a bad one.

A militiaman is liable to service for five years in time of peace, but in the case of war or other extraordinary circumstances, his service can be prolonged by a law passed annually for that purpose. He may not, except by his own consent, be sent to the Colonies or foreign possessions.

The King has the power in case of emergency to call out the whole or part of the militia, but must at once assemble the States-General, if they be not sitting, in order that this act may be legalized.

The militia is liable to be called out once every year to be drilled during six weeks, but the King may, if he please, declare this unnecessary.

The duration of the first training is twelve months, but those who have passed through a certain educational course may, if they have acquired a fair knowledge of theoretical and practical military work, be dismissed on unlimited furlough after six months. After the first training, the whole levy of the year is allowed to go on unlimited furlough for the remainder of their term of service, subject only to their liability to be called out, should such a proceeding be considered necessary.[1]

In practice, a portion (about one-seventh) of the annual levy is kept with the colours for sixteen months, or until the levy of the succeeding year is sufficiently trained to do duty.[2]

In a pamphlet[3] lately published, an Officer of the Dutch Army proposes to free the militia levies from all duties except drill parades, and that the latter shall take place twice in the day. He hopes thus to be able to reduce the length of the training to eight months, a change which he considers would be both economical and popular. This is probably true, but on the other hand it must be urged that the training of a soldier implies more than the mere learning of drill, and even sixteen months does not appear a long period of instruction when the task of the Officer or non-commissioned officer is to transfer a crowd of unruly louts into cleanly, obedient, and well-disciplined soldiers.

Under the new law for the militia which was presented to the States-General in September, 1881, it is ordered, in addition to the changes noted above :—

That the Ballot shall be held in March, and the conscript be called up during the first half of October;

That the *larger* half of an odd number of brothers shall be taken;

That the age of a substitute, by place-changing, shall be between twenty-two and thirty ;

That every recruit shall receive furlough during some part of his year of training ;

That *one-sixth* of the five levies can be kept under arms if required, in addition to those serving their first year.

In addition to the army and militia, there exists in the Netherlands an auxiliary force, named the "Schutterij," which goes back for its origin to the sixteenth century, but was almost entirely remodelled by law in the year 1827.

Every native male is bound to serve in the Schutterij for ten years, namely, from the twenty-fifth to the thirty-fifth year of his age, and of this period he passes five years in the Active Schutterij, and five in the Reserve. Every "commune"[4] is required to have 2 per cent. of its male inhabitants in the Active Schutterij, but if the total number of inhabitants of any commune is

[1] This is the regulation for 1881 ; the rules for 1880 were even less stringent.

[2] By law one-seventh of the five contingents of the militia, in addition to those who are undergoing their first training, may be kept under arms.

[3] "De Aanhangige Militie en Schutterijwet getoetst aan onze Militaire en finantieele belangen," door een Infanterist.

[4] "Gemeente."

less than 2,500, its members serve only in the Passive Schutterij.[1] Vacancies in the ranks are annually filled by ballot, but number-changing is permitted within limits.

The Schutterij is organized in three bans—

1st. The unmarried, and the childless married men and widowers.

2nd. Married men and widowers who have small families, and who are not absolutely dependent upon their profession, &c., for their support.

3rd. The remainder of the Schutterij.

It is laid down by the Constitution that, as soon as the whole of the militia has been called out, the Schutterij are to be mobilized and drilled. The auxiliary forces are liable to service in the following order:—

1st. Any volunteers who offer for service.

2nd. The unmarried, or, if necessary, the whole of the 1st ban.

3rd. The 2nd ban.

4th. The remaining members of the Schutterij.

5th. In the case of the most urgent need the "Landstorm."

The assembly of the last must, however, be accompanied by an extraordinary meeting of the States-General, in order that its necessity may be solemnly declared. The Landstorm is subject to the following rules:—

1. The Landstorm, or that part of it which is first available for service, shall be employed to fill up the army and train, and shall be in all ways paid, rationed, and rewarded as is the army.
2. Under no circumstances can the Landstorm be required to serve beyond the frontiers of the kingdom.
3. All place-changing is forbidden in time of war.

The Landstorm receive no military training, and that of the Schutterij is at present little more than nominal;[2] but it is proposed to improve the present system, and to give the latter instruction, both theoretical and practical.

It was further ordered in 1867 that whenever more than ten persons may form a society to practise rifle-shooting, they shall, if the King's consent be obtained, be supplied by the Government with the necessary ammunition, and if possible with arms, and with instructors from the army.

By the new law for the Schutterij proposed to the States-General in September, 1881, the following rules are made:—

All males are liable to service from the 1st January of their twentieth year, and are to be called up in the January and February of their twenty-first year. The enrolment, which is for ten years, is to take place in March. If not enrolled at an earlier date every man is liable to service up to his thirtieth year; but the term of ten years is in any case to include militia service.

Volunteers are received, provided that they enlist for at least two years in peace, and serve in war as long as they may be required.

The following are exempted:—

1. Those who fail in height or health.
2. Those who have served ten years in the army, navy, &c.
3. Some Government officials.
4. The clergy and theological students.

The Schutterij is to be divided into two classes, viz.:—

(*a*) Those who are sufficiently trained: these are to attend drill for an aggregate of from forty to fifty hours in the year.

(*b*) Those insufficiently trained, or entirely untrained, who are to be drilled during from ninety to one hundred hours in the course of the year.

[1] "Rustende." They do no drill.

[2] The Active Schutterij is assembled at the most for one hour once a fortnight between April 1st and October 1st, for drill and ball practice.

The Organization and Strength of the Army.[1]

Infantry.

(*a*) 1 Regiment of Grenadiers and Jagers.
(*b*) 8 Regiments of Infantry of the Line.

Each regiment consists of 5 battalions, of which, in the case of (*a*), 3 are grenadiers and 2 jagers.

Each battalion consists of 4 companies, of 1 Captain, 3 subalterns, and 210 rank and file, and has a total strength of 20 Officers and 932 men.

Each regiment consists of 107 Officers and 4,660 men.

It is intended that there shall be the following proportion between volunteers and militia, viz. :—1 to 5.

Volunteers : 35 per company = 140 per battalion = 700 per regiment, and total 6,300. Militia : 175 per company = 700 per battalion = 3,500 per regiment, with a total of 31,500.

This will give a grand total of—

37,800 rank and file ; add to this
1,404 serjeants.
1,676 corporals.
936 Officers of all ranks.

41,816 grand total.

The Infantry is organized in three divisions, each of fifteen battalions.
1st Division : Regiment of grenadiers and jagers + 4th regiment + 7th.
2nd Division : 1st regiment + 5th regiment + 8th regiment.
3rd Division : 2nd regiment + 3rd regiment + 6th regiment.

In addition to the above there is a battalion of instruction, and a discipline battalion ; the Hospital Corps is also included among the Infantry.

Cavalry.

3 regiments of Hussars, each of 5 field squadrons and 1 depôt squadron. A field squadron consists of 1 Captain, 4 subalterns, and 190 rank and file, of whom 80 are volunteers and 110 militia ; total, including non-commissioned officers, &c., 223, with 10 Officers' chargers and 120 horses.

A regiment, including the depôt squadron, consists of 44 Officers and 1,276 non-commissioned officers and men, with 77 chargers and 746 troop horses. Under the head of "Cavalry" are included also the riding and farriery school, and a squadron of 100 rank and file, termed "Ordonnansen," whose special duty it is to provide orderlies and escorts.

Artillery.

(*a*) A corps of Horse Artillery, consisting of 2 batteries of 6 guns each, and one battery of instruction.
Each battery comprises 1 Captain, 3 subalterns, and 156 rank and file, of whom 40 are volunteers, and 116 militia ; total : 4 Officers, 180 non-commissioned officers and men, 8 chargers, 127 troop horses.
The battery of instruction contains 1 Captain, 1 subaltern, 160 men, 4 chargers, and 58 troop horses.

(*b*) 3 regiments of Field Artillery, of which each regiment consists of 2 divisions ; one of 4 batteries of 6 guns, the other of 2 batteries of 6 guns, and 2 companies of the Train.
A battery contains 1 Captain, 3 subalterns, and 136 rank and file, of whom 20 are volunteers and 116 militia : total : 4 Officers, 161 non-commissioned officers and men, 4 chargers, and 70 troop horses.

[1] In all cases these are given at the full (paper) war strength, and perhaps represent more what is wished than what exists.

A company of the Train consists of 4 Officers, 189 non-commissioned officers and men, 4 chargers, and 45 troop horses.[1]

(*c*) 4 regiments of Garrison Artillery, of which one is trained especially for coast defence; each regiment consists of 10 companies.

Each company contains 1 Captain, 3 subalterns, and 162 rank and file, of whom 12 are volunteers, and 150 militia; total, with non-commissioned officers, 4 Officers, 183 men.

There is also a company of instruction, which consists of 1 Captain, 5 subalterns, and 227 non-commissioned officers and men.

To the Artillery also belong—

(*d*) The Pontoon Trains of 2 companies, each of 4 Officers and 260 non-commissioned officers and men, of whom 205 are militia.

These should rather be described as a bridging train, as they have no wagons or horses, nor apparently any portable pontoons.

(*e*) The Torpedo Corps, which is principally recruited from fishermen, &c. It consists of 2 companies, each of 4 Officers, and 219 non-commissioned officers and men, of whom 150 are militia.

There is also a company for training non-commissioned officers, and a company of artificers.

Engineers.

(*a*) 3 field companies of 3 Officers and 159 men (90 militia).
(*b*) 8 fortress companies of 3 Officers and 166 men (90 militia).
(*c*) 1 railway and telegraph company of 6 Officers (5 subalterns) and 184 men (90 militia).
(*d*) 1 depôt and instruction company of 3 Officers and 208 men.

Proposed Organization of Field Army.

1 Cavalry Brigade of 3 regiments of 3 or 4 squadrons + 2 batteries horse artillery.

3 divisions, of which the headquarters would be at the Hague, Arnhem, and Breda.

Organization of a Division.

Infantry—3 regiments of 4 battalions.
Cavalry—1 or 2 squadrons.
Artillery—1 regiment = 36 guns.[2]
1 company of Engineers.
1 company Hospital Corps.

There will then remain for the fortresses, &c.—

9 battalions of Infantry.
4 regiments = 40 companies of Garrison Artillery, 3 companies Engineers and the Torpedo company.

Nominal strength of the Army by the Organization of July, 1880.

Arm.	Officers.	N.C.O's.	Volunteers.	Militia.	Total.
Infantry	926	3,080	6,300	31,500	40,880
Cavalry	121	480	1,655	1,650	3,785
Artillery	416	1,185	1,213	9,930	12,328
Engineers ..	92	143	400	785	1,328
	1,555	4,888	9,568	43,865	58,321

[1] Mostly cast from the Horse Artillery and Field Artillery or Cavalry.
Only 4 batteries would be ready at first.

Of these 6,234 volunteers were wanting, of whom 5,490 were needed by the infantry.

Probable strength of Field Army.

Infantry, 36 battalions ± 820 men = ± 29,500 men.
Cavalry, 15 squadrons ± 125 men = ± 1,875 „
Artillery, Horse ± 300 men and 12 guns.
„ Field ± 2,009 „ „ 108 „
Total, 33,675 „ „ 120 „

Infantry : cavalry : : 15 : 1.
Guns, 3·6 per 1,000 men.

The Schutterij has[1] the following strength :—
Active, 212 companies, of which 27 are Garrison Artillery.
Passive, 89 battalions, divided into 385 companies.

	Active.		Passive.	
	1st ban.	2nd ban.	1st ban.	2nd ban.
Officers	434	159	697	387
N.C.O. and drummers ..	1,610	726	2,254	962
Privates { active ..	15,249	5,430	32,098	6,036
Privates { passive ..	10,158	8,259	20,073	13,666
	27,451	14,574	55,122	21,051

Of these have served in the army,

As N.C.O.	621	254	310	160
As Privates	7,144	2,955	12,233	5,249
	7,765	3,209	12,533	5,409

giving a total of 118,198, of whom 28,916, or about one-quarter, have served.

Weapons of the Dutch Army.

Infantry. The Beaumont rifle, which is a breech-loading central-fire arm, having a calibre of ·433″, rifled with four grooves, sighted to 2,000 yards, and with an initial velocity of 1,332′. Length with bayonet fixed 72″, without the bayonet 52″. Weight, with bayonet 10·5 lbs., without 9·7 lbs.

The cartridge is of brass, the charge weighs 77 grains, and the bullet 378 grains.

Entrenching tools are to be supplied in the proportion of 40 shovels, 16 hatchets, and 2 pickaxes to each field company.

Cavalry. The Remington carbine, a breech-loading arm, of which the calibre is also ·433″; it has four grooves and is sighted to 500 yards. Its weight is 7·1 lbs., and its length 36″. The charge weighs 65·5 grains, and the bullet 336 grains.

The cavalry sword is 40·1″ in length, and weighs with its steel scabbard 4·4 lbs. Non-commissioned officers and trumpeters carry a revolver weighing 2·8 lbs.

[1] 1st January, 1880.

Artillery. The dismounted men wear a special short sword, with a leather scabbard.

The mounted men have the cavalry sword (as above), and the limber-gunners the old pattern cavalry sword 39 inches in length, and weighing 5·1 lbs. with its steel scabbard.

The field and horse artillery carry also a revolver.

The guns at present in use are bronze breech-loading wedge guns, and are on iron carriages. The calibre is 3·3″, and there are twelve grooves. The shells are provided with a lead coating and rings, and are of the following descriptions :—

Common shell, used with a percussion fuze ; weight, filled 13·1 lbs., bursting charge 7·7 oz.

Shrapnel shell, with 80 lead bullets, weight 14·8 lbs., bursting charge 2 oz. used with a time-fuze.

Case—108 bullets, weight 13·4 lbs.

The charge is 1·8 lbs.

Each limber carries 30 common shell and 12 shrapnel, and four rounds of case are with the gun.

In each wagon are 72 common and 32 shrapnel shell.

With the batteries are carried 151 rounds per gun, with the ammunition column 53 per gun for Field Artillery, 70 for Horse Artillery.

The extreme range of the gun is about 3,300 yards.

Two gunners are carried on the axletree boxes and three on the limber.

The guns and wagons have each six horses, the other carriages four, and the weight drawn by each horse is, in the Horse Artillery 700 lbs., in the field batteries 800 lbs.

Engineers are armed with a special carbine and sword. Carbine, almost the same as that of the cavalry, but sighted to 650 yards, and provided with a bayonet. Sword, a broad heavy blade, which may serve as a pioneer's tool ; they also carry pioneers' and carpenters' tools in a bandolier over the left shoulder.

In war the infantry carry 60 cartridges each, the cavalry 30.

The Schutterij are at present armed with the Snider rifle, but are to receive the infantry arm as soon as a sufficient number have been made.[1]

Provision was made in the estimates of 1880 and 1881 for the purchase of 120 steel field guns of 3·3″ calibre.

Supply.

In time of war the principal magazines will be at Amsterdam, Woerden, and Dordrecht, with depôts for clothing and equipment, &c., at Amsterdam, Woerden, and Delft. Military bakeries will also be established at Leeuwarden, Groningen, Deventer, Harderwijk, Milligen, Arnhem, Nijmegen, Grave, Venlo, Maastricht, Amersfoort, Hertogenbosch, Naarden, Utrecht, Gorinchem, Breda, Amsterdam, Haarlem, Hoorn, The Hague, Bergen-op-Zoom, and Flushing.

It may not be out of place to state here the impressions given by what was seen of the Dutch Army during a short tour in Holland.

The infantry are small men, but look strong and healthy ; they are certainly not smart in appearance, but that may in some degree be owing to the fact that they seldom appear in any other dress than a long ill-shaped great-coat. Their drill to English eyes appears slack, and is apparently modelled rather on the French than the German system ; but one point in it appears worthy of note, which is, that battalion drill, in place of being carried out on a level parade, was in one case at least executed on a very

[1] On the 1st January, 1880, 137,863 small-bore rifles were ready.

broken piece of ground. The Officers are very smart in their dress and manner, but the men are, as a rule, loutish. The uniform is dark blue, with an utterly useless aiguillette fastened to the left shoulder, while the shakos might by their shape be relics of Waterloo, and are surmounted, at least in the grenadiers, by a very conspicuous white plume, which is, however, probably removed in the field. As a measure of the size of the men, it may be mentioned that in no one case was any man seen who, even in a high shako, was not overtopped by his bayonet when holding his rifle at the "order." The cavalry are even smaller than the infantry, and their long swords look very much out of proportion to the wearers. Their uniform is dark blue with red braid, and their busbies and overalls are of the French exaggerated pattern. In general appearance the cavalry are certainly inferior to the infantry, and do not give a favourable impression, whether mounted or dismounted, though such horses as were seen were excellent and well cared for.

The men of the artillery were better set up, looked more intelligent, and were far more soldierlike than those of the other arms; they appeared indeed almost as if recruited from another class. No horse artillery were seen, but such horses of the field batteries as came under notice were very good, well-groomed, and most serviceable.

The Officers in all arms seemed bigger than their men, but this may only be the effect of the youth of the latter. Every non-commissioned officer wearing a medal, and therefore of some length of service, was noticeable at once among the others by his very soldierlike appearance. The Dutch Officers wear their swords well, and do not, as is too often the case with us, allow them to hang more nearly horizontal than vertical; but in the matter of length of straps the mounted branches of the Dutch Army are far too profuse.

The above statements are given only as impressions, and are liable to every correction, since the specimens of the army seen may have been in no way representative.

The Navy.

The dockyards, storehouses, &c., are at Amsterdam, Hellevoetsluis, and Willemsoord at the Helder, and there are two harbours for the navy, namely, Hellevoetsluis and the Nieuwe Diep, at the Helder.

The strength of the navy in August, 1879, including the ships then on the stocks, was as follows:—

1. *For the defence of the Coasts and Roads.*

28 ironclads, one of 6 guns, one of 4, one of 1 gun, and the remainder of 2 guns each. Draught of water from 4′ 3″ to 19′, with horse power ranging from 50 to 400, and carrying from 40 to 152 men.

30 unarmoured iron gunboats of 1 gun each.[1] Draught of water 6′ 6″, with engines of 30 horse power and each with a crew of 22 men. Also one steel boat, carrying 2 guns, drawing 3′ of water, and having a crew of 30 men.

It is intended that the smaller of the above, with others of the same class which are to be built, should assist in the inland defence, and for this purpose a large canal is to be made from the Zuider Zee to the Hollandsch Diep, connecting Amsterdam, Utrecht, and Willemstad, by way of the Vecht, to the Lek and the Merwede.

2. *For General Service.*

Two ironclad rams, carrying their guns in turrets, built of iron, and each

[1] 16 have the 28 c.m., and 14 the 23 c.m. gun.

carrying 8 guns. Draught of water 19·6′ and 18′, horse power 600 and 400, crews 250 and 230.

Unarmoured ships, &c., seven of the 1st class, of from 10 to 14 guns, drawing 18′ to 20′ of water, with engines of from 250 to 500 horse-power, and with crews of about 200 men.

Two of the 2nd class, of 6 guns each, drawing 16′ of water, with engines of 280 horse-power, and crews of 130 men.

Three of the 3rd class, of 3, 6, and 7 guns respectively, drawing 14·5′ of water, of 119 to 140 horse power, with crews of 100 men.

Four of the 4th class of 3 or 4 guns, with a draught of water of 11·5′, of 90 horse-power, and with crews of 75 men.

Under this head come also an old frigate (screw) of 51 guns, and a paddle-steamer of 6 guns.

3. *Guard Ships.* (*Sailing Ships.*)

7 of from 2 to 12 guns, consisting of 2 frigates, 1 corvette, and 3 gunboats for instruction.

2 frigates, 2 corvettes, 1 brigantine, 2 brigs, and a gunboat.

Omitting those vessels which come under the last head, the strength of the navy was, therefore, in 1879—

(*a*) *For Coast and Inland Defence:*

Armoured	28	vessels of	53 guns.
Unarmoured	31	„	32 „

(*b*) *For General Service:*

Armoured	2	vessels of	16 guns.
Unarmoured	18	„	178[1] „
Total	79		279 „

The rifled guns in use are the

28	centimetre, or	11″	gun,	of which	there are	23
23	„ „	9″	„	„		44
18	„ „	7″	„	„		6
17	„ „	6·6″	„	„		18
16	„ „	6·3′	„	„		49
15	„ „	6″	„	„		3
12	„ „	4·7″	„	„		75
						218

The remaining guns on board ship are S.B.

Personnel of the Navy.

Omitting the Surgeons and non-combatant officers, &c., the navy consists of—

1	Admiral.
2	Vice-Admirals.
4	Rear-Admirals.
20	Captains.
40	Commanders.
120	Lieutenants, 1st class.
225	„ 2nd „
50	Midshipmen.

462 Officers and 5,601 petty officers and men, of

[1] Omitting the frigate, 127 guns.

which last 1,272 are militia. The Corps of Marines[3] consists of 3 battalions of 4 companies each, and a depôt company; it has a strength of 56 Officers and 2,186 men.

A conscript of the militia who volunteers and is accepted for sea service, serves four years, and is on his discharge relieved from any further duty with the Schutterij. The sea militia are not, except in case of necessity, to be called upon to serve in the Colonies, but must pass the whole of their first year on sea service, unless exempted from it by the King. After their first year of service the sea militia are not liable to be called out for more than six weeks in any one year.

In case of war the sea militia may be called out either wholly or in part, but this summons is always to be immediately followed by the assembly of the States-General, and is to be authorized by them.

IV.—The Politico-Military Position of Holland.

In order fully to realize the various changes that have been undergone by the foreign relations of the Dutch, it is necessary to describe briefly their position in former years with regard to the rest of Europe.

Every one has read of the magnificent struggle with Spain by which Holland was first raised to the position of an independent Power, and which continued during the latter half of the sixteenth, and the earlier half of the seventeenth, century.

During the remainder of that age Holland had two special foes, France by land, and England by sea. Germany was occupied by internal dissensions, Austria suffered from the incursions of the Turks and from the rebellion of Hungary, while Prussia was as yet in the infancy of its power. France was, on the other hand, ruled by a young King, eager for military glory, though, if report be true, a little sparing of his person, who found ready to his hand an army formed by Richelieu and kept up by Mazarin. The internal condition of the country was all that even Louis XIV might desire, since the great vassals of the Crown, whose forefathers had so often striven almost with success to drive his ancestors from the throne, were now perfumed courtiers, whose highest happiness was gained if the "Grand Monarque" deigned to smile on them. England, on the other hand, was beginning to feel her strength; few in number, her armies had done little since the days of Agincourt, but her navy, created and trained by the rash ventures of needy heroes, was fast rising in importance in the consideration of the world. It was impossible that two nations, lying so near together, and separated by the sea, of which both claimed the mastery, should long remain at peace.

Accordingly we find that the annals of Holland at this period are filled with naval battles with England, while the French, as before mentioned, strove to extend their frontier to the Rhine, which then as now they claimed for their natural boundary.

In the eighteenth century, it is still the French from whom Holland has most to fear, and against whom we find her striving in alliance at various times with the English and Imperialists. To cover the southern frontier of Holland so many fortresses were built, that at last a campaign became practically a succession of sieges. At length France, grown feebler and feebler from the waste of her finances, was driven within her bounds, only to issue forth again after the bloody challenge thrown by her in 1793 to the Kings of the world.

Holland in 1795 became a province of France, at once in fact, at last in name, and so remained until the great European convulsion which threw Napoleon from his throne, and restored to her her independence, burdened with debts, incurred for wars which she had not desired.

[3] As organized on 1st September, 1880.

In 1815 all Europe feared France, and it is interesting to note how every effort of the Congress of Vienna had but one aim, to make the egress of a French Army from French territory as nearly as might be impossible, by engaging the interests of each of the other nations against such an advance. Switzerland was placed, as a neutral country, under the protection of all; in touching her France would draw on herself the enmity of Austria, and of Germany: the latter with Prussia guarded the middle Rhine, while Holland and Belgium, as the kingdom of the Netherlands, was a sufficient Power to cover the right flank of Germany; England also, it was understood, would resist any action in this direction, and the Allied Powers were bound by treaty to furnish 60,000 men to aid in the defence.

A grand system of defence was decided upon in 1818 at Aachen or Aix-la-Chapelle, and its plan was entirely directed against France.

In order to ensure the co-operation of England nine fortresses were to be kept up, and of these, in case of any threat of war, six were to be occupied by English troops.

A second series, of ten fortresses, was intended to facilitate the intervention of Prussia, and of these in case of war the latter was to hold five.

Three other fortresses closed the space between the Scheldt and the Maas, and of these the Dutch were to occupy two, and Prussia one.

A fourth system held by the Dutch was to cover Holland, which lastly was to serve as a central *réduit*.

It has not been considered necessary to give the names of these fortresses, since the whole system fell to pieces in 1830, at the separation of Belgium from Holland, and also because not one of these strongholds, with the exception of modernized Antwerp, exists at this moment as a fortress.

Thus in 1830 Holland was thrown back on her own resources for defence, and from that date until the present day efforts, at first spasmodic, but lately systematic, have been made to work out an adequate system for her protection.

In 1830 Holland yet feared France; she had long given up the struggle with England for supremacy at sea; her southern neighbour was hostile but harmless Belgium, while Hanover, still an appanage of the Royal House of England, sheltered her on the east from insult or injury.

So matters continued until the sudden success of Prussia in 1866, and the consequent absorption of Hanover by that Power, gave the Dutch a new neighbour, too warlike to be neglected, and too covetous to be loved.

The attention of the Dutch was, therefore, at this date directed principally to their eastern frontier, and the southern, between which and danger Belgium served as a shield, was comparatively neglected. If the weight of Prussia in the minds of the Dutch more than counterbalanced that of France in 1868, how much more, after the war of 1870, must the influence of the latter have become a matter of history, while that of the former darkened the country like the shadow of a threatening giant.

But, it may be asked, why should Prussia desire to annex Holland? To this the answer is easy, or rather there are many answers. Prussia, poor and warlike, is earth-hungry; she has so increased of late, that she believes it to be her mission to spread until her realm is bounded by the sea. Even there she will not rest; she has now such an army as the world has probably never before seen, so organized and so trained that she does not look upon defeat as possible, but she has as yet comparatively no navy, at least none such as she would make had she a sea-board and a population of sea-going men. With her army she proposes to rule Europe; with a navy she thinks she might rule the world.

Prussia has two harbours for her navy, Kiel and Wilhelmshaven, of which the principal, the former, lies in the Baltic, and may thus be practically closed by a fleet blockading the narrow entrance of that sea. She is further

dependent for her supply of sailors on the population of her northern coast, which lies on a sea that for many months of the year is ice-bound. The annexation of Schleswig-Holstein has undoubtedly served to make a navy possible to Prussia, and therefore to Germany, but a far greater development is needed before the latter can have much weight in the world in matters naval.

Again, who shall say whether the Prussians, as a race, have the genius for maritime war, in which the French, who also in their time have been supreme on land, are naturally deficient? But the Dutch are born sailors, as we have learned in many a naval fight, and Prussia, who needs no addition to her army, would rejoice to add to her dominion a province of which the people would supply the very best material for that part of her force which is presumably the least efficient.

The spirit of colonial enterprise, choked in Germany by the small extent of her coast, has always flourished and still flourishes in Holland. This little State, whose total population is no greater than that of London, is the second colonial Power in the world, and rules dependencies of the area of 600,000 square miles, and containing 24½ millions of inhabitants, and, stranger yet, rules them with a distinct profit to the State.

Must not a small nation, so decked with rich possessions, be a standing temptation to her powerful but poor neighbour, who daily sees thousands of her sons quit her shores and abandon her nationality for those of other lands, which have more promise or more wealth? Had Germany a navy she would soon have Colonies; had she Colonies those who now leave the Fatherland for foreign countries might be induced (or perhaps compelled) to live under the German flag in other latitudes, and who can doubt but that the thrifty, pushing Prussian would succeed in a new country where what are most needed are economy and energy?

Holland has Colonies, harbours, and a navy, the latter indeed small, but as large numerically as that of Germany, while Prussia, lacking all these, has a giant army, needing war as an excuse for its existence, is not overburdened with sickly scruples, has a way of spelling "might" as "right," in defiance of orthography, and is divided from Holland by a merely artificial frontier. May we not then assume that the temptation to annex Holland always exists for Prussia, and, judging by past events, is it too daring to prophesy that, given the opportunity, Prussia is no prude to resist indefinitely?

With regard to the feelings of the Dutch on this matter, that is surely shown most plainly by the sacrifices to which they submit for the purpose of defending their land. They are confessedly not a military people, and are proud to be merchants and farmers rather than soldiers; yet, with but few exceptions, they are eager to lend their aid to any scheme which may preserve their independence, even though that scheme may entail, as in the case of the military inundations, the temporary loss and the slow and expensive recovery of many thousands of acres of fruitful land.

The national and anti-German feeling is, as might be expected, strongest in the west or heart of Holland. On the eastern frontier, for many years, intercommunication was frequent with Hanover, and labourers crossing and recrossing the boundary grew to greater likeness in speech and customs; but even at Arnhem we have the evidence of a hearer[1] that a Dutchman, on being asked if he drank the Rhine water, answered: "I drink that water, when perhaps Germans have bathed in it? Pah! it makes my gorge rise."

Yet in Holland, as in other countries, there are two classes who look upon all military preparations as a useless waste of money. These may be described as the "optimists," and the "pessimists," those who are prepared to accept

[1] M. Henri Havard, in his book, "Les Frontières Menacées."

whatever may come, and those who consider all resistance as hopeless. The feelings of both classes have their rise in indolence or in want of imagination.

There is yet a third class, and that the most dangerous, composed of those who would prefer the rest given by the rule of a Great Power, to the doubt and fear excited by the threatening aspect of the future. Given the opportunity, these men may betray their country, and will certainly be among the first to recommend submission. The only two invasions of Holland which have been entirely successful, that of 1787 and that of 1794, were assisted materially by internal discord, for the Prussians were led into Holland by the Stadhouder, and the French by the Republicans. But the heart of Holland is in the main sound, and her people, so tenacious of their land, their liberties, and their language, will, when the time of trial comes, be faithful to the history of their nation; and even Prussia, so powerful and so prodigal of blood and iron, may well hesitate to incur the cost at which the possession of Holland must be bought. But it must be acknowledged as almost certain that, except on the condition of foreign intervention, Holland must in time succumb to the numbers and resources of her neighbour. When the preparations of the Dutch are completed, they will have, so they consider, such defences as may be held for two years against almost any odds. Accepting this most favourable view, we may ask, "and after that?"

After that must come surrender, unless in the meantime some Power or Powers shall have, for selfish or other reasons, decided to stand by Holland, and shall have successfully aided her in the struggle.

Of the Powers of Europe who will help her?

France is not ready for war; she seems, indeed, if all we hear be true, to be even less in a condition to fight than she was in 1870. She has more men, it is true, but not so many soldiers, and the state of transition into which she entered after the German war appears to be still so feverish and chaotic, that there is at present no sign of any good end.

Austria, as Germany has no heart to fight Germans, as Magyar has no interest in the West. She has, in addition, been provided with employment in Bosnia sufficient to draw her attention eastwards. Again, "Italia" is still "irredenta," and the cry which is now stifled may, should it offer any promise or serve any purpose, be taken up from the Alps to Sicily.

Italy has enough to do to nurse her finances, is jealous of France, and is in the first stage of a fever, in whose delirium she may grow to believe that the Mediterranean must be an Italian lake. What is Holland to her, or she to Holland?

Germany, having Prussia at her head, is practically one with Prussia; and, moreover, any conquest would probably be undertaken, and even held, in the name of Germany, though at the order and to the profit of Prussia.

Belgium, the nearest neighbour of Holland, has never been her friend, and, weak as she is, could scarcely be expected to offer aid to a falling Power, especially when such an offer might serve as an excuse for her own destruction or absorption. In two cases only does it seem likely that Belgium would assist Holland against Prussia: first, if she knew, or believed that she knew, that any action of hers would be supported by France, at the risk, or perhaps with the object, of producing war between the latter and Germany; or second, if, there being no hope of help from France or any other Power, she realized that the conquest of Holland was but the first step towards her own annexation.[1] Yet, even in this latter case, she might be content to await the issue of events within the forts of Antwerp.

Omitting Spain as too remote and too unhealthy for effort; the Scandinavian Powers, who would scarcely move for fear of taking a false step; and

[1] It is reported that there is an understanding between Holland, Belgium, and Denmark, with regard to their mutual co-operation in defence.

Denmark, who is in process of extinction, there remain but Russia and England.

Russia, suffering from her anti-German rage, combined with her internal madness, may do anything, and it is impossible to foretell to what pitch of extravagance her actions may not rise. One of two events seems, however, probable: either she may undergo a war with Germany, followed by a revolution, or the revolution may come first and the war follow. But, except as an excuse for such a war, it is not easy to see how the condition or conquest of Holland can in any way affect her.

England has the most to lose by the loss of Holland. She cannot afford (even from a pecuniary point of view) to have another rival for supremacy at sea, especially since that rival would possess harbours and arsenals within twelve hours' steam of her coasts. We have been friends, we have been enemies, with the Dutch, who do not love us for the share, of which most Englishmen are ignorant, which we took in wresting Belgium from their rule. But, loving us or not, they would accept our aid, for some aid they must have in their need, or they must fall.

It will probably be acknowledged that the aim of Prussia in acquiring Holland will be to take through her a forward position as a maritime Power. It will also perhaps be allowed that we, who, until our recent successes in Egypt, owed our chief prestige to our supremacy at sea, cannot endure the sudden growth of a new, an energetic, and a warlike rival, whose ships, manned by seamen who in a hundred fights have shown themselves the equals of our own, would be equipped in harbours adjacent to our coasts, within easy reach of the fair-way of our commerce, or would sail in foreign seas in numbers eventually as great as our own, to seize and occupy new lands, to which the superabundant population of the Fatherland might pass, and whence wealth might be drawn for the warlike Power which is rich in everything but gold.

The question, whether we should fight for the defence of Holland, is one which cannot now be answered, if only because it is impossible to say under what circumstances England may be called upon to give her decision. But two things are certain: the first, that from a military and naval point of view, it would be a grievous error (some may add disgrace) to remain quiet while Holland was engaged in almost hopeless strife, yet fighting our battle with her own; and the second, that, previous to late events, neither the Dutch nor Europe believed that we should move, even under the direst provocation.

The question of how Holland may best be aided by a foreign Power will be considered later.

V.—The General Plan of the Existing and Proposed Defences of Holland.

As has been already mentioned, the kingdom of the Netherlands was in 1830 divided into Holland and Belgium; each of these thus found herself compelled to rely only on her individual strength for defence against enemies which had, even before the separation, been more powerful than their united force.

From that time commenced in each country an agitation for some system of defence, and in 1850 a Committee was appointed in Holland to examine into the details of such a scheme. The result of the war of 1866 rendered a decision even more necessary, and the excitement caused by that of 1870 at length obliged the production of a settled plan, the law establishing which was passed by the States-General on the 11th March, 1874. By this law it was laid down that the defences should consist of the following:—

(*a*) The New Water-line of Holland,[1] which extends from the Zuider Zee by

[1] The province is meant.

Utrecht to the Lek, from the latter to the Merwede, and thence through the land of Altena to the New Merwede.

(*b*) The position of the Gelder Valley, with that in the Lower Betuwe, ordinarily known as the Grebbe Line. (Map No. I.)

(*c*) The position on the Hollandsch Diep, and the Volkerak. (Map No. I.)

(*d*) The position of the mouth of the Maas and the Haringvliet. (Map No. IV.)

(*e*) The position of the Helder. (Map No. II.)

(*f*) The works on the Gelder Ijsel, Waal, and Maas. (Maps Nos. I, III, and V.)

(*g*) The position of Amsterdam.

(*h*) The Southern Water-line, which extends from the Maas above Fort St. Andries to the Amer below Geertruidenberg.

(*i*) The works on the West Scheldt. (Not shown on map.)

These were by the project of the law to be completed in the following order :—

1st. (*a*), (*e*), and parts of (*f*) and (*g*).
2nd. (*c*) and (*d*).
3rd. (*b*) and the remainder of (*f*).
4th. Remainder of (*g*).
5th. (*h*).
6th. (*i*), of which it is proposed to omit further mention, as it is certain that the defences on the Scheldt will not be repaired and kept up.

The system was to be completed in eight years from the 1st January, 1875, at a total estimated cost of 2,500,000*l.* ; of this sum, 1,041,600*l.* had been expended on the 31st December, 1879.

By this law all the old fortresses which were not already dismantled were ordered to be demolished, and the sites of their fortifications are now, for the most part, laid out as public gardens.

The scheme of defence is formed upon the following considerations : Holland is liable at any time to attack from an enemy whose strength is immeasurably superior to her own, and it must therefore be impossible to guard the whole of her soil directly against an invasion. Rather she must be content to maintain a position in some previously chosen part of her land, with the intention, as soon as circumstances shall permit, of issuing from her lines to regain possession of the territory before abandoned ; or, if that be impossible, to prevent at any rate the quiet occupation by the enemy of his conquest, and to secure her own existence as a nation to the very last.

It would be impossible for the Dutch to fight on their borders, since their army is small, while their frontiers are long[1] out of all proportion to the extent of the country, and are moreover entirely artificial, and are provided with no natural obstacles or demarcations. Should such an attempt be made, the army might be crushed at the commencement of the campaign, or might be cut off in its retreat on an interior defensive line.

It has therefore been determined to place the true line of resistance in the centre of the country, and to concentrate every effort at the points where the nature of the ground itself will give the greatest amount of aid. It has been already shown that the defence towards the east is far weaker than towards the south, and if further proof be needed, we have only to examine the course of previous invasions. Of the eight attacks which have been made on Holland during the last three centuries, six have been directed on the eastern frontier, and two only on the southern, while of the latter, that of 1793 failed almost before it had begun, and that of 1794 was successful on account of the peculiar hardness of the winter, which rendered the inundations useless, and of

[1] Especially the sea coast.

having found its advance facilitated and even guided by men who were more republican than patriotic.

Again, the signs of the times, and Dutch opinion, point to the eastern frontier as that on which danger threatens, and we shall therefore find that the principal efforts of the nation have been directed against an advance from that point.

The two provinces of North and South Holland have been selected as the seat of concentrated defence, and they will be covered towards the east by the New Water-line, on the south by the various coast fortifications which close the mouths of the rivers, and on the north by Amsterdam, which also forms a *réduit*, or last retreat.

These two provinces have been selected on various grounds. They contain the capital of the kingdom, the seat of government, the three most important commercial towns, and almost all the main harbours, and are moreover the richest and most populous of all the provinces of Holland. But all these reasons had probably less weight in the choice than the fact that of all the country this is the lowest, the wettest, and the most highly cultivated portion. It is thus by far the easiest to defend, for not only is it enclosed on three sides by the sea or by large rivers, but on the fourth side the nature of the country permits the formation of a very wide line of inundations. The ground itself also almost entirely consists of polders and drained lakes, which may be flooded one after another and be defended foot by foot. It is further exceedingly rich in supplies, both of corn and cattle, whereas the east of Holland is poor and sterile.

The commercial and political value of Amsterdam would necessitate its choice for the site of the last national fortress, even if it were not the case that the country around it is of all Holland the lowest and the most intersected.

To sum up, (*a*) the New Water-line is the main line of defence, to this (*g*) Amsterdam forms, as it were, a citadel, while the other defences serve only a subsidiary purpose, and are employed each for some local object.

The Southern Water-line (*h*) was intended to resist an attack from the south, but so little dread have the Dutch at present of such an invasion, that this line has been almost entirely neglected, except with regard to those portions of it which close the navigation of the Waal and Maas, or cover the southern flank of the New Water-line.

The approaches to the latter from the sea are closed by (*c*) the position at Willemstad, (*d*) that at Hellevoetsluis, while (*e*) that of the Helder is intended to prevent the passage of a hostile fleet into the Zuider Zee, or the landing of an enemy to the north of Amsterdam.

There remain only (*b*) the Grebbe line, and (*f*) the lines of the Gelder Ijsel and the Waal: these are intended as advanced posts which shall delay the enemy's movements and shall thus give time for the formation of the inundations on the New Water-line; and are further to be employed to protect the retreat of any troops which may have been pushed forward to observe or hinder the march of the invader.

For the Dutch do not propose, at the first declaration or act of war, to withdraw into their defences as a snail into his shell; on the contrary, it is intended that no province shall be abandoned until the retreat of the army becomes a necessity, since by so doing the resources and possibly the military services of its inhabitants would be lost, for they might prefer in such a case to remain at home, in order, if possible, to secure their property from pillage.

The present system of defence arranges for the occupation of bridge-heads, &c., on the line of the Gelder Ijsel, beyond which, if necessary, the cavalry and advanced bodies of infantry will be employed until driven in by the enemy.

When the line of the Ijsel has been forced or turned, the field army will fall back on the Grebbe line, and thence, when pressed by superior force, on

the New Water-line, avoiding everywhere any serious action, but at the same time using their utmost endeavours to retard the advance of the enemy, and thus to gain time for the completion of the inundations. The character and defects of the Ijsel and Grebbe lines will be hereafter considered in detail, and it has been thought sufficient to give here the reasons for their existence.

It is also considered that some such advanced line is necessary, in case that Holland, though not suffering invasion, be called upon to make her neutrality respected in the event of a war between neighbouring States. It is held that with this object it would not be sufficient to take up a purely defensive position in the centre of the country, but that the army must, by the nature of the case, be advanced to the frontiers, in order to resist any violation of the territory. In either event few defences would be required, and thus we find that most of the old forts have been or are to be dismantled.

The *Revue Militaire*[1] states that the Minister of War has lately presented to the States-General of Holland a law which very much modifies that of 1874. It is found that the necessary fortifications cannot be completed by the date at first given (1st January, 1883), and a further period of six years is demanded, making a total of fourteen years, ending 1st January, 1889.

Without going into details, which will find their proper place under the next heading, it may be mentioned that under this law the defence is to take a yet more concentrated form, since all works not directly of use to the New Water-line are to be condemned. Thus it is proposed to give up a great part of the Southern Water-line, and also the forts on the West Scheldt, a proceeding which, it is stated, will result in a saving of about 600,000*l*., part of which is to be expended on the construction of defences at the railway bridge, which at Moerdijk crosses the Hollandsch Diep.

It is hoped that what has been written above has made sufficiently clear the general character and object of the present system of defence of the Dutch; but, before proceeding to examine the actual details of each position, a short space must be given to the description of the design and mode of execution of the proposed military inundations, and also of the usual type of fort employed in Holland.

(I.) The Netherlands, as its name implies, and as every child knows, is a country so low and flat that the traveller on first entering the country wonders how sufficient fall can be obtained to allow of that drainage of water to which the land owes its existence, and indeed it is only by extreme skill, and by making the most careful use of even the smallest difference of level, that the rivers can be persuaded to run into the sea, which at many places is at flood tide above the mean level of their course.

Holland has thus no rising ground[2] such as would generally be chosen for a defensive position, but the disadvantage which she labours under as regards the command of ground by the fire of the defence is more than made up to her by the fact that owing to the nature of her soil, and to her power of inundating the land at will, the front of attack may in almost every case be limited to the width of a road or dyke along which *only* the enemy can advance.

By careful levelling it may be discovered in time of peace which roads, &c., will remain above water, and the forts may be so arranged as entirely to bar all means of access. Nor is this power of as it were ordering the assumption of a particular line of attack, and at the same time limiting its front to a minimum, the only advantage offered to the defence by the use of water as an obstacle; for it is evident that the existence of the flooded land will oblige the defender to make all his approaches and batteries on the dykes, and this, on account of their small width,[3] he can only do at the cost of sacrificing the use of them as roads. It is true, however, that, if the invader can succeed in

[1] 1st April, 1882.

[2] Except in the east of the country, *e.g.*, around Arnhem.

[3] Seldom, except the sea-dykes, of greater width than 12 feet at the top.

any way in making the inundation passable, then in many cases the dykes will serve as traverses to protect his advance from the fire of the forts, while at all times they screen his movements, and conceal the efforts that he may make to remedy or nullify the inundations.

All ground can be flooded which lies lower than the water-courses around or about it, but it is not found in practice to be either necessary or desirable to take full advantage of this power. Polders and lakes which have been artificially drained can be easily flooded by merely stopping the mills (wind or steam) which daily pump the water from them; but this process is slow, and, in the case of very hot and dry weather, may fail entirely. In that event, water may be let in either through sluices previously prepared, or in an emergency by piercing the dyke. The latter course is, however, if possible to be avoided, as by so doing all command over the water is lost, and no limit can be set to the inundation. Again, all ground can be inundated which, lying along the side of a river, is ordinarily protected from floods by the river-dykes, provided of course that at the time the level of the land is below that of the water. Indeed in most cases the formation of inundations would imply merely the restoration of the land to the condition from which it has been reclaimed; but there always exist certain localities in every inundation and in every line, of which the difference of level, though very slight, renders it difficult or impossible to cover them with water; again, as we shall find later, it is in many cases necessary to bring water from a distance by special canals, for the purpose of flooding districts which are higher or but little lower than the adjacent water.

The sources from which water may be drawn to form inundations are—

(*a*) The large rivers.
(*b*) The small rivers.
(*c*) The sea.
(*d*) Rain and the springs.

(*a*) The large rivers, such as the Rhine, the Waal, the Maas, and the Lek, though they vary constantly in height, yet always supply a large quantity of water, and are therefore more to be counted on as a source than are

(*b*) The small rivers, many of which are fed altogether by the rain-fall, and may thus at times be dry.

(*c*) The sea has two great advantages as a source of water: it is inexhaustible, and it is always approximately at the same level, but its use entails great depreciation in the productive power of arable land, especially if the latter have a clay soil.

(*d*) Rain and spring water are only available under certain circumstances, when the supply is so abundant that it exceeds the natural evaporation.

Many of the localities selected for flooding can be inundated with water from more than one of the above sources, and indeed it is often necessary to provide means for drawing off the surplus water.

The object aimed at in forming a military inundation is that it shall be so deep as not to be fordable, and so shallow that it is not navigable, but the actual depth and amount of water required depends very much upon the character of the soil.

If this be of clay, or marshy, it is sufficient just to cover the surface with water, as it then becomes so slippery and soft, that it is practically impassable by troops. The same may be said in the case where the ground is intersected with ditches and water-courses, since these, when hidden from view by the overlying water, form impracticable obstacles. Firm sand, which is not cut up by ditches, is the most unfavourable ground, as it may almost always be passed, unless inundated to a great depth, in which case it will become navigable.

The Dutch have selected a depth of from 6 to 20 inches, as that which

best answers all requirements: a greater depth than the latter would also tend to make the inundation larger than necessary, which implies an enormous increase over the amount of water estimated to be required.

For this reason, and on the ground of the unlikelihood of the supply being equal to the demand, the Dutch hold that broad inundations will, as a rule, be easier to pass than narrow, but they lay down no absolute rule on the subject, recommending only that when possible the breadth should be sufficient to prevent the guns of the assailant from commanding the defender's edge.

Even in Holland, to the eye so flat and level, the ground in the course of some miles has necessarily a fall in some direction, and, seeing how small a margin is allowed by the variety in depth given above, it is obvious that in order to ensure approximately the same depth along a line of 20 or 30 miles, it is necessary to divide that line into several basins, each with its own level. This is done by means of some of the existing dykes, or by special dykes[1] constructed for the purpose, which bound the various fractions, each with a different inundation level to the other, but with the same throughout the extent of each basin. There are two difficulties with regard to these dykes; firstly, as they form approaches along which the enemy can cross the inundation they must be defended; and secondly, if the level of two basins vary very considerably, there is a certain risk that the enemy may, by piercing the intervening dyke, run off the water from one into the other, and thus make one fordable and the other navigable.

The dykes which exist between the polders, &c., and which are not needed as "Komkeeringen," must be pierced, so as to allow the water to spread over the whole basin.

The quantity of water required for an inundation depends naturally upon the extent of ground to be flooded, and the depth of water required, but two other considerations affect it considerably, namely, the time of year and the nature of the soil: the time of year, because in a dry season the ground will absorb more of the inundation water than it can when saturated with rain; and the soil, because the ground must be saturated before the water will commence to rise, and sandy ground will thus require far more to flood it than will a clay or marshy soil. In order, therefore, to calculate the amount of water required for a given inundation, it is necessary not only to multiply together the length, breadth, and depth, but the product also must be multiplied by a certain co-efficient in order to allow for the water which sinks into the ground. In clay or marshy ground this co-efficient will be about ·05 to ·1, while in sand it may rise as high as 3. Assuming that 1,000,000 cubic yards be the volume of the inundation; then the amount of water required will be for clay or marsh land 1,000,000 + 100,000 = 1,100,000 cubic yards, and for sandy soil 1,000,000 + 3,000,000 = 4,000,000. The data required for calculating the time necessary for the formation of an inundation are: the amount of water needed, the number and width of the sluices, &c., by which the water can flow in, and the difference of level between the locality to be inundated, and the source whence the water is supplied, or, to be more correct, the difference of level between the water at the source and the water in the basin.

Thus favourable conditions for an inundation as regards rapidity of completion are—

1. Small area and depth.
2. Clay or marshy soil.
3. Wet weather.
4. Large sluices.
5. A great difference in the water-level.

[1] Komkeeringen.

The latter may be assisted by spreading the inundation water, as it pours in, over as large an area as possible, and for this purpose steam pumps may be employed.

The advantages of inundations to the defender have been already mentioned; one great disadvantage attends their use, namely, that they render it impossible for him to assume the offensive, since the assailant has then all the advantage on his side. Another failing of such a system of defence is that it cannot at all times be ready, nor can it be certainly relied upon, since, owing to the enormous loss occasioned by its use, the flooding of the land is certain to be delayed as long as possible, and may easily be delayed too long. If the inundation has not been formed before the arrival of the invader, the latter may be able to prevent its completion unless care has been taken to select as sources of water points behind the inundations,[1] and to protect them with fortifications.

The assailant may endeavour to make the inundations passable in one of two ways: he may let in water in order to render them navigable, or he may let out water with the view of fording them. To counteract such efforts the defenders should have it in their power to add or to draw off water when necessary, and under any circumstances such power is needed to enable them to counteract the effects of heavy rain or excessive evaporation.

Inundations may also be rendered passable, and therefore useless, by a severe frost, and many plans have been suggested to overcome this defect, which, however, appears to be almost insurmountable.

It has been proposed to run off some of the water after one or two days of frost, and thus to leave only a weak coating of ice, while the air beneath it might serve to prevent the freezing of the lower stratum of water. In practice it is found that the length of time necessary to draw off the water renders this plan of little use.

Another plan suggested is to keep the water in continual motion, by letting it off on one side and in on the other, but since even the large rivers in Holland are often frozen, it is obvious that, in order to prevent the formation of ice, the stream must be very powerful, while the nature of the inundations renders impossible the production of a swift stream; at best this plan can avail only with regard to canals and small streams. Again, the ice may be broken by alternately raising and lowering the water-level, but this is not easy, if only on account of the amount of time required for the operations.

Ice may be broken up by explosives, or by manual labour, or by specially built steamers; in any case care must be taken to draw the broken pieces from the water, or they will be quickly re-frozen into a solid mass. With regard to the use of explosives, it has been found by experiment that the effect of their use, great as it is locally, extends over but a small area.

Inundations made with salt water are of course little liable to freeze, but from a financial point of view they are disastrous, especially on clay or arable land, which is by their use so injured, that it requires many years of careful culture to bring it round.

On sandy or pasture land the effect is not so bad, and there are even certain places where the land is intentionally flooded every year for a short time with sea-water; but the loss to the country by the use of salt or fresh water inundations will vary very much, as to its amount, according to the time of year at which they are formed.

(II.) As might be expected, the forts in Holland, built as they have been under similar conditions, and to serve identical ends, have considerable resemblance to each other, though no two are exactly alike. As regards the trace, they may be roughly classed under four heads, namely:

(a) The small forts, old pattern.

[1] This is not always possible.

(*b*) The small forts, new pattern.
(*c*) The medium and large forts, old pattern.
(*d*) Do. do. new pattern.

(*a*) These forts, which are intended to defend only a single approach, and that probably not of great importance, are as a rule of but little value against modern artillery, since they consist of a brick or masonry keep, resembling a large Martello tower, surrounded, but not in the least covered, by a parapet either circular or polygonal, which again is encircled by a wet ditch. But of these there are but few, as no great expense is necessitated by the construction of

(*b*) These are small redoubts, intended for the same purpose as the above, and consisting of an earthen parapet without revetment, surrounded by a wet ditch which has no flank defence. They have little strength save such as is afforded by their position, which is, however, as a rule, very favourable for defence, since they stand on the only dry ground in the vicinity, and completely command the very narrow dykes by which they may be approached. Of such fortifications as these there is a great number, for in some parts of the country every line of access is covered by one.

(*c*) The forts of this pattern are polygons of 4, 5, or 6 sides, each of which is defended by some modification of the bastioned trace. The sides appear to be often too short to allow of good flank defence, and the bastions are often dangerously small. The guns as a rule fire either through shallow embrasures, or over the parapet, in which latter case they are divided by traverses and bonnettes. The centre of the front parapet is very frequently so raised as to form a cavalier battery, while bomb-proof barracks are built under a large and high traverse which extends almost across the fort. The rear face is generally of slighter profile, and in some cases the gorge is closed by a loop-holed wall. The keep or *réduit* is built of brick, has generally a small parapet on the top, is frequently of very great height, and is in many cases covered by a high counter-guard, from which it is separated by a wet ditch which surrounds the whole circuit of the *réduit*. The ditch of the fort is almost invariably wet, and is always of very considerable width. Neither the escarp nor the counterscarp are as a rule revetted, though to this there are exceptions; the road which the fort is intended to guard usually runs along the counterscarp, though in some cases it leads directly through the fort.

(*d*) The new pattern forts are, as regards their trace, a combination of the bastioned with the polygonal system, their ditches being, as a rule, flanked by caponiers, while their sides are indented on a principle which has much in common with the bastioned trace. Their internal details resemble in general plan those of the class (*c*), but the traverses are higher and thicker, and the keeps and cavalier batteries have even more command, while their bomb-proof accommodation is far more complete.

Few of the forts have any covered way, glacis, or indeed any works beyond the ditch. As might be expected, the larger and more complete forts are used to cover the ground in front of Utrecht, which cannot, on account of its level, be secured by complete inundations.

Owing to the nature of the country, since water is almost everywhere within a few feet, or even inches, of the surface of the soil, no cover for magazines, &c., can be given by excavation; for this reason, as also because the Dutch seek by raising some portion of the parapet to obtain a considerable command over the surrounding country, the forts strike the observer as presenting an unusually good mark for the assailant's fire. Another defect common to many of them is caused by the fact that the ground around them is overgrown up to the counterscarp with copses, woods, orchards, &c., while trees of a very small height are in this singularly level country capable of shutting out the entire view. The enemy, it would appear, could always see

the keep, while, unless much wood be cut down, he would himself be invisible from the parapet.

Few of the forts visited had their guns mounted, though in many cases they were on skids on the ramparts; the guns seen were small, apparently about 16 or 20 pounders, and were by no means all breech-loaders.

VI.—The Details of the various Defences and Inundations.[1]

The New Water-line of Holland, being the principal line of defence, claims to be first considered; this extends from Muiden and Naarden on the Zuider Zee, by Utrecht to Vreeswijk on the Lek, thence along the Diefdijk to Asperen, from which it runs by the Linge to Gorinchem on the Merwede, to the south of which it passes through the land of Altena to the New Merwede. It has a total length of about 40 miles, from the Zuider Zee, which covers the left flank, to the Hollandsch Diep, on which the right rests, and it is defended along nearly the entire front by a chain of inundations. The soil is almost universally favourable to the latter, being clay, while the country consists of polder land, divided by few dykes, but intersected in all directions by numberless ditches: from this it results that the minimum of water will be required, since the ground is not absorbent, and the inundations need not be deep.

The ground on the east of the line, which will be in the occupation of the invaders, is from the south as far as the Lek low and wet; above the Lek it is higher, and on the east and north-east of Utrecht is sandy, and therefore comparatively dry; the inundations from Utrecht to the Zuider Zee are bounded on the east by higher ground, which will prevent any possibility of the water being drawn off by the enemy. To the west of the line the ground falls, thus giving the defenders great power over the water of the inundations, which, being retained by dykes, may be regulated by sluices.

The northern part of the water-line forms practically part of the position of Amsterdam, with which it is connected by Fort Nieuwersluis.

It will be convenient to divide the water-line into four parts, which will be considered in turn, viz.:

1. Between the Zuider Zee and the Lek.
2. Between the Lek and the Waal.
3. Between the Waal and the Maas.
4. To the south of the Merwede.

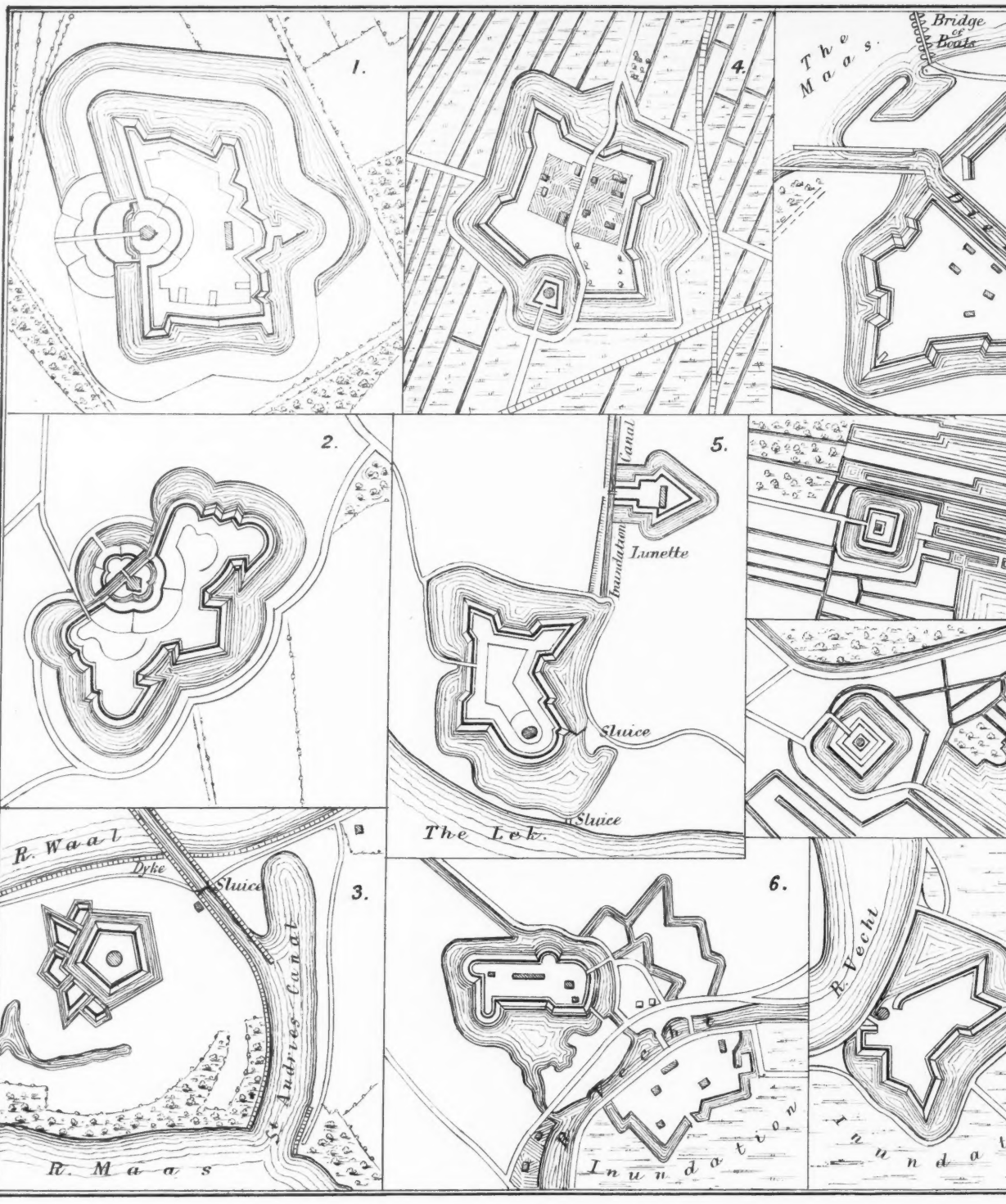
1. *The part between the Zuider Zee and the Lek.*

Inundations.—Since the ground between the Lek and Muiden falls 3 or 4 yards, it is necessary to divide the inundations in the interval into four basins.

1*st Basin.* This is bounded on the north by the Zuider Zee, on the west by the Vecht, on the east by rising ground, while to the south it extends as far as Forts Gagel and Ruigenhoek, and is, for purposes of inundation, further divided into two parts by the dyke which runs north-east from Fort Tienhoven.

Of these parts the more northerly is flooded with sea-water, obtained by opening a sluice at Muiden, where the sea has a mean level of 10″ above the river Vecht: the sea-water would thus run up the river, and would be admitted over the land by opening the sluices in the right dyke of the latter. The ground to the south of Naarden is very much intersected with ditches, and is at all times in many places covered with large sheets of water.

[1] It is impossible, without unduly lengthening this paper, to give every detail of the formation of the inundations, or to do more than offer a general idea of this most complicated subject.



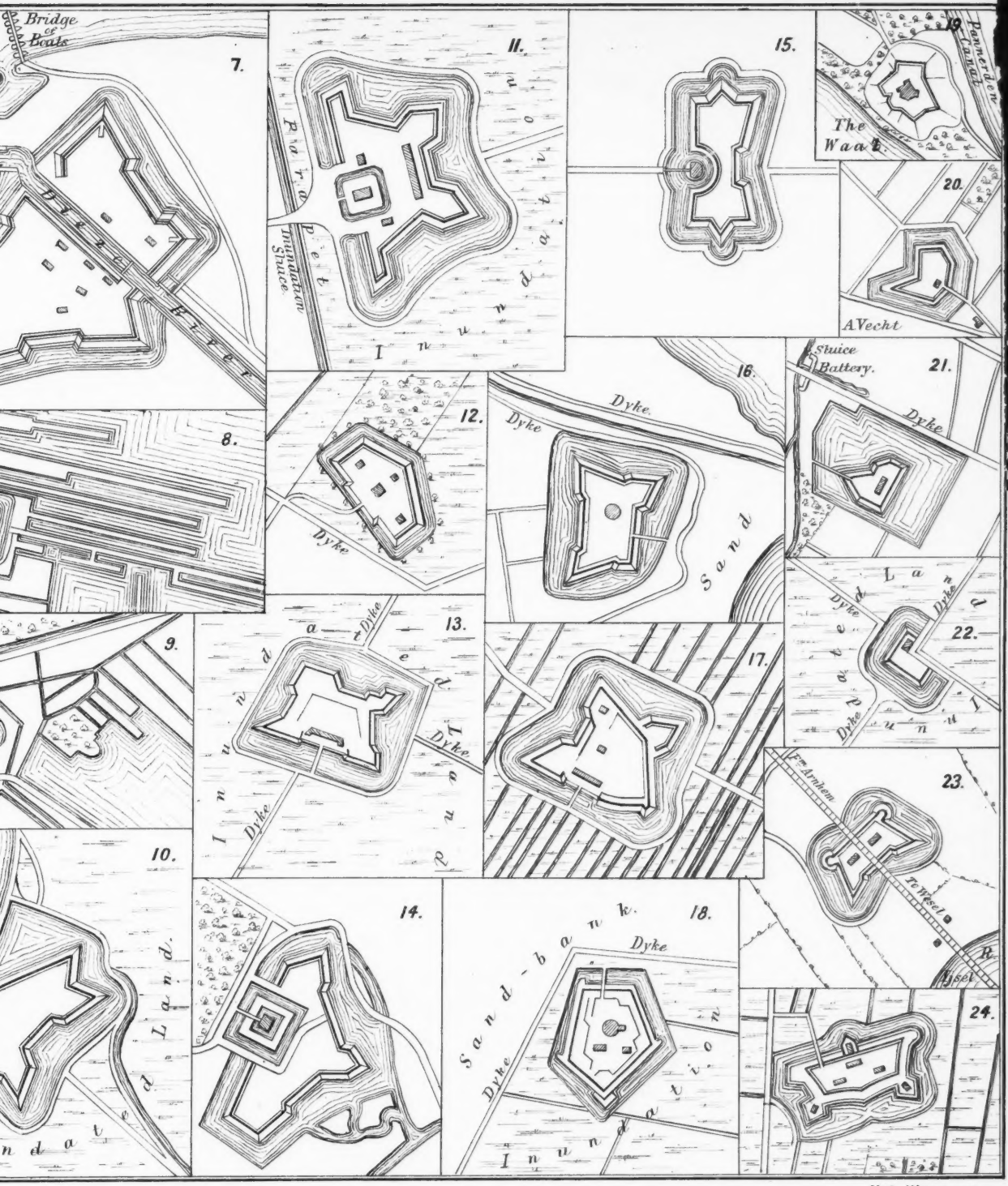
1. *Fort Rijnauwen, New Waterline.*
2. *Fort Vechten, do.*
3. *Fort Nieuw St. Andries, S. Waterline*
4. *Fort Blaauw Kapel, New Waterline.*
5. *Fort at Honswijk, do.*
6. *Fort Nieuwersluis, do.*
7. *Fort Crèvecœur, S. Waterline*
8. *Fort Spion, New Waterline.*
9. *Fort Kijkuit, do.*
10. *Fort Uitermeer, do.*
11. *Fort de Bilt, do.*
12. *Battery on Hoofdijk, do.*

TYPES OF FORTS

Scale $\frac{1}{10,000}$

100 0 100 200 300 400 500

Harrison & Sons Lith. St Martin



N. L. WALFORD

FORTS IN HOLLAND.

Scale $\frac{1}{10,000}$

400 500 600 700 800 900 1000 Yds

13. *Fort Ruigenhoek, New Waterline.*
14. *Fort Vossegat, do.*
15. *Fort Jutfaas, do.*
16. *Fort Prins Frederic, Volkerak.*
17. *Fort Voordorp, New Waterline.*
18. *Fort de Ruiter, Volkerak.*
19. *Fort Pannerden, Upper Waal.*
20. *Fort de Klop, New Waterline.*
21. *Fort Bovensluis, Volkerak.*
22. *Fort de Gagel, New Waterline.*
23. *Fort Westervoort, Gelder Ijsel.*
24. *Fort Hemeltje, New Waterline.*

s Lith. St Martins Lane W C

The southern portion of the 1st basin will be inundated with water from the Lek through the Vaartsche Rhine and the Vecht, which last will be dammed at Nieuwersluis, while the sluices in its right dyke will be opened. The difference of water-level between these parts will be about 19″, the former having a level of [1]A − 7·8″, the latter of A + 11·8″.

Little loss would be suffered by the use of sea-water in the northern part, since the country is there peculiarly barren, while the advantage gained by the use of two sources is invaluable as regards the saving of time.

2nd Basin. This extends to the south-east as far as the road which runs through Fort Blauwkapel. It is inundated from the Lek, through the Kromme Rhine, into which water is admitted through a special inundation sluice at Wijk-bij-Duurstede, and is allowed to flow over the land by opening sluices in the various waterways near Utrecht. The level of flood of this basin is A + 23·6″.

3rd Basin. This is a very small triangle to the north-east of Fort Blauwkapel; it is flooded by the same means as those used for the 2nd basin, and has an inundation-level of A + 51″.

4th Basin. This is divided into two parts by the Kromme Rhine and the higher ground near it, but each part has the same level of inundation, namely, A + 61″.

The northern portion is by far the smaller, and includes only the inundation to the east of Utrecht, while the southern extends along the Vaartsche Rhine to Vreeswijk on the Lek.

Part of the ground in front of the Lunettes at Utrecht, shown in the map as flooded, is left dry; as is also a strip along the north side of the Lek, varying in width from 650 yards on the east to about 200 yards, but the water reaches the dyke of the Lek at two points, one in front of Vreeswijk, the other about half-way between that fort and Honswijk.

The water for the northern part of this basin is obtained in the same manner as that for the 2nd and 3rd basins; that for the southern from the Lek by a sluice near Honswijk by means of a special inundation canal; but each can be inundated from either source. If the Lek be low, all inundations depending upon it for water must necessarily fail either in completeness, or in rapidity of formation, and to obviate this defect, it has been proposed to construct an inundation reservoir on the Lek at Vreeswijk; but it appears that such a plan cannot be carried out until the actual declaration of war, owing to a convention made in 1868, at Mannheim, between the States which lie along the Rhine, to the effect that no works should be constructed by any one of them which might tend in any way to impede the river traffic. It has therefore now been resolved to dam the Holland Ijsel below Gouda, and to draw the superfluous water thence by pumps, &c., and so to supply the need.

With regard to the time required to complete the inundations between the Zuider Zee and the Lek, it is given that, supposing that all canals, ditches, &c., are already full, it will—

If the level at Honswijk be	A +	65″	require	12 to 13	days.[2]
„ „	A +	86″	„	6 „ 7	„
„ „	A +	106″	„	4 „ 5	„

Fortifications.—Muiden, a fortress at the mouth of the Vecht, which covers the approaches from Naarden, whether by road or canal. It has a bastioned trace with wet ditches, and possesses some bomb-proof accommodation. The mouth of the river is defended by the West Battery, which stands on the left bank. The garrison of Muiden would be from 800 to 1,000 men.

[1] All water-levels in Holland are referred to the mean level of the Ij at Amsterdam; this is called the Amsterdam "peil" or level.

[2] Of 24 hours.

Naarden, 8,200 yards from Muiden, is a bastioned fortress, with wet ditches, bomb-proofs, and some outworks. The escarp is revetted. It covers various roads, and also the railway from Amersfoort. The Ronduit, which covers the space between Naarden and the sea, is an earthwork with a wet ditch, and provided with bomb-proofs, and is connected with Naarden by a covered way.

Garrison of Naarden, about 1,000 men.

In front of Naarden stand—

On the east, three lunettes[1] of no great importance,[2] and further commanded by higher ground to the eastward.

On the south, two batteries on the Karnemelk ditch, a battery on the Koedijk, and two batteries in front of Bussum. All these are earthworks, and, except the two last, have all wet ditches. They are intended to serve as outworks to Naarden, and to fill the space between the lunettes and the inundation.

Weesp, 2,700 yards south of Muiden, is on the left bank of the Vecht, has three bastioned fronts which cover the town towards the east. The ditches are wet, and there is a defensible bomb-proof barrack. It covers the sluices by which water is drawn from the Vecht to make the inundations round Amsterdam, and guards also the railway, canals, &c. Its garrison is about 200 men.

It is evident that a great change will take place, as regards the object and value of these fortresses, when the proposed scheme to drain the whole of the Zuider Zee has been carried out; but it is at present impossible to discuss their future condition, since we have no data as to the character of the undertaking.

Fort Uitermeer,[3] about 2 miles to the east of Weesp, is an earthwork of an irregular bastioned trace, standing on the right bank of the Vecht. It has a wet ditch and bomb-proof accommodation, and is intended to defend the railway and the roads which pass near it.

Fort Hinderdam, which lies 1,600 yards south of Fort Uitermeer, is situated on an island on the Vecht. It is a small earthwork, with a wet ditch and a bomb-proof guardhouse. It was built to cover the sluices which were at one time at this point, but has now no particular object, since the only road near it would almost certainly be covered by the inundation.

The dykes and roads further to the south are guarded by Forts *Kijkuit* and *Spion*,[4] which are both small square earthen redoubts with wet ditches and bomb-proofs. These forts serve also to prevent the passage of the inundations, should they become navigable, by means of boats or rafts. Kijkuit is 4,500 yards from Hinderdam, and the same distance from Spion.

Fort Tienhoven, a similar redoubt, lies on the dyke which separates the two parts of the first basin of the inundation, and serves to guard it and the canal on it. Tienhoven is 4,500 yards from Spion, and 2,700 from *Fort Maarseveen*, which is not yet completed;[5] it will be an oval fort, of which the longer side faces east; it also has a wet ditch.

In rear of the outer line formed by the last three forts, stands *Fort Nieuwersluis*,[6] on the Vecht. This is a large and important fort, and is undergoing great improvement. The principal defences are on the left bank of the river, and consist of a wet ditch and an earthen parapet of an irregular shape with a very high cavalier. It contains also sufficient bomb-proof cover

[1] The so-called "offensive of Naarden," but of late the name, as well as the intention of offensive operations from this quarter, has been abandoned.

[2] The centre lunette has its gorge closed by a loopholed wall; the others are open.

[3] No. 10 plate of forts.

[4] Nos. 8 and 9 plate of forts.

[5] It is to be finished this year.

[6] No. 6 plate of forts.

for its garrison. It covers the sluices in the Vecht which serve to inundate the country about Amsterdam, guards the road from Utrecht to the capital, and also the Rhine railway, and closes the dykes along the Vecht. This fort forms the south-east pivot of the defence of Amsterdam, and is the connecting link between it and the water-line.

The next portion of the line, that between Fort de Klop and Fort Jutfaas, forms the position of Utrecht; the ground being here less easily inundated, is therefore less defensible, and, in consequence, the forts are not only larger, but also nearer together.

Utrecht is an important junction of roads and railroads, and is further from the same cause that weakens its defence, the point in the line most suited to the assumption of the offensive. Of the forts composing the position, the following were built before 1840, namely: de Klop, de Gagel, Blaauwkapel, de Bilt, and Vossegat, and the four lunettes to the south-east of the city; these are, except the two first, only 1,600 to 2,200 yards from Utrecht. Between 1867 and 1869 were built Forts Ruigenhoek, Voordorp, Rijnauwen, and Vechten, of which the second is 2,700, the others from 3,800 to 4,400 yards from the city; during the last few years the forts on the Hoofddijk and Hemeltje have been added to these.

Fort de Klop[1] is a moderate sized redoubt, with a wet ditch and bomb-proofs. It is about 3,300 yards north of Utrecht, and guards the dyke upon which it stands, as does also *Fort Gagel*,[2] which is situated 1,500 yards in front of de Klop. The latter is a lunette with a wet ditch, but the gorge is open.

About 3,000 yards from Fort Gagel is *Fort Blaauwkapel*,[3] a large square bastioned fort, with wet ditches, and having an isolated brick *réduit*. It serves to defend the road which passes through it, and also two lines of railway.

Fort Ruigenhoek[4] stands to the left front of Blaauwkapel, in the centre of a perfectly open meadow. It is a four-sided bastioned fort, with a wet ditch and bomb-proofs. It serves to defend the front of Blaauwkapel and de Gagel, and to close the dyke on which it is situated.

Fort de Bilt,[5] 2,200 yards from Blaauwkapel, stands very near to the city on the road leading to the village from which it takes its name. It is a large bastioned fort, with a high cavalier battery, bomb-proof barracks, and a brick *réduit*. The ditch is wet, and the road runs along the counterscarp. The fort serves also to guard an inundation sluice which lies close behind it.

Fort Voordorp[6] lies in advance of and between Forts Blaauwkapel and de Bilt. In general arrangement it resembles Fort Ruigenhoek, and serves to defend the dyke on which it stands, and the fronts of the two neighbouring forts. It is armed with 28 guns and 4 mortars.

Fort Vossegat[7] is situated 1,300 yards from Fort de Bilt. It consists of two bastioned faces and a gorge parapet, with a wet ditch and a *réduit* containing bomb-proof barracks. It lies on the north bank of the Kromme Rhine, and serves to assist in the defence of the ground which cannot be inundated.

The battery on the Hoofddijk,[8] to the north-east of Vossegat, has been but lately completed. It is a lunette with an obtuse salient; it has a wet ditch, but the gorge is open. It is about 1,500 yards from de Bilt and from *Fort Rijnauwen*,[9] a very large but irregular fort, with a wet ditch flanked by caponiers, which defends the dry ground, and covers the Arnhem railway. It has a brick keep surrounded by a wet ditch, and capable of independent defence. Its garrison numbers 1,000 men, and it is armed with 123 guns and 18 mortars.

[1] No. 20 plate of forts.
[2] No. 22 plate of forts.
[3] No. 4 plate of forts.
[4] No. 13 plate of forts.
[5] No. 11 plate of forts.
[6] No. 17 plate of forts.
[7] No. 14 plate of forts.
[8] No. 12 plate of forts.
[9] No. 1 plate of forts.

Fort Vechten,[1] 1,500 yards distant from Rijnauwen, is situated on the other bank of the Kromme Rhine, and guards the open ground, the railway from Arnhem, and the road from Wijk-bij-Duurstede. It had at first a bastioned trace, but the parapet has now been indented, in order to allow of the fire of a greater number of guns. It has a brick keep similar to that of Rijnauwen, and has about 2,200 yards of clear range, while the fire of the latter is much hampered by the woods which lie close in front of it. Its garrison numbers about 900, and it is armed with 102 guns. The two latter forts are also intended to cover the advance and protect the retreat of any offensive movement from the position.

Coming nearer to Utrecht, we find a line of four lunettes posted to cover the approach to the city by road or rail. These works have revetted escarps, and a loopholed wall at the gorge. They are of considerable size, and of some strength, but are so close to Utrecht that they could scarcely be defended. Since their wet ditches must be crossed by bridges, they tend also to make an offensive movement more difficult by narrowing the exit.

There is also around Utrecht, in rear of the forts, a covered road with a parapet and barbettes for field guns. It starts from near Fort Vossegat, and runs by Bilt to Blauwkapel. It is so near to Utrecht that it can be of little use, and though covered by a wet ditch the profile is too weak to permit of any real defence.

About 3 miles from Utrecht, and on the east bank of the Vaartsche Rhine, stands *Fort Jutfaas*,[2] a fort of considerable size, on a modified bastion trace ; it has a wet ditch and bomb-proof barracks, and is to be armed with twelve guns of 12 c.m. and four 29 c.m. mortars. It is intended to cover the gap which here exists in the inundations, and is assisted in this task by two advanced batteries, which have each bomb-proof barracks and magazines, and of which the garrison is about 200 men. Fort Jutfaas is about 3 miles from Vechten, and as this distance is too great for mutual assistance, a new fort, *Hemeltje*,[3] has been begun between the two. It does not appear to be as yet completed, but will have an obtuse salient, two flanks, and a gorge-parapet ; the ditch is wet, and is defended by caponiers. To the south of Jutfaas the next approach is formed by the ground along the north dyke of the Lek, which lies too high to allow of inundation, and also, when the river is low, by the alluvial ground between it and the dyke. This line therefore requires a strong defence, more especially as in it lie the sluices at Honswijk and Vreeswijk.

Fort Honswijk,[4] a modified bastioned fort, with wet ditches and a bomb-proof barrack, stands on the dyke of the Lek. It is assisted in defending it by a lunette at a little distance, and by a battery still further to the north, each having a garrison of 120 men. The latter has a bomb-proof barrack, and the three works are connected by a covered way which runs along the inundation canal. Another battery, also provided with bomb-proof barracks, lies on the Lek dyke, about 3,500 yards behind Honswijk, while at *Vreeswijk* is a small irregular redoubt with a wet ditch, which is intended to guard the sluice at that point.

It is impossible to pass from the consideration of this section without remarking upon the obvious danger which arises to the defenders from the very advanced position of Wijk-bij-Duurstede, where lie the sluices which are of the greatest importance for the formation of the inundations. That place is entirely undefended, and, indeed, is so far in advance of the main line that it is difficult to imagine how any defence may be possible ; so that an enter-

[1] No. 2 plate of forts.
[2] No. 15 plate of forts.
[3] No. 24 plate of fo ts.
[4] Garrison: 2 companies infantry, 1 company artillery, and armed with 93 guns. No. 5 plate of forts.

prizing enemy may, by two forced marches,[1] possess himself of the principal source from which the water for the flooding of the Utrecht line is drawn, and may thus seriously delay, if he does not altogether prevent, the success of the inundations, upon the sufficiency of which hangs the whole scheme of defence. It is also worthy of remark that the besieger's position in front of the Utrecht line is far higher and more healthy than that of the defender's.

2. *The Section between the Lek and the Waal.*

Inundations.—The country to be flooded is bounded on the west by the Diefdijk as far as Asperen, at which point the inner edge turns to the west, as far as the Zederick Canal, parallel to which it runs southwards to Gorinchem; the eastern boundary may be seen on the map, but the scale of the latter is too small to make it possible to describe its course in detail.

This section is divided into three basins, viz.:—

(*a*) Between the Lek and the north dyke of the Linge.
(*b*) Between the north and south dykes of the Linge.
(*c*) Between the latter and the Waal.

(*a*) The first basin has an inundation level of A + 61″, and a breadth from east to west of about 7,600 yards. The water required to flood it is drawn from the Lek through the ditch of Fort Everdingen, and through a sluice near Fort Spoel, and is distributed by special canals over the basin. If the water supply of the Lek is insufficient, the inundation may be formed by means of a sluice in the north dyke of the Linge. The sluices at Fort Everdingen, three in number, are each 70″ wide, and that at Spoel has a width of 8½ yards.

(*b*) The second basin, since it consists only of the land between the river dykes, is of only small breadth. It is inundated by damming up the Linge, by shutting the sluices which lie near Asperen, and, if necessary, the supply of water may be increased from the Waal by means of a sluice below Tiel, through an inundation canal.[2] The level of this basin when flooded must be at least the same as that of (*a*), and would generally be higher, since it may have to supply water both to the latter and to (*c*). The main level of the Waal at Tiel is A + 17 feet, and is therefore about 12 feet higher than the inundation level of this basin.

(*c*) The third basin has an inundation level of A + 39″, and even then a width of from 550 to 650 yards is left dry along the northern dyke of the Waal; but the water on the northern edge will probably extend up the southern dyke of the Linge. The water required may be taken from the second basin when filled from the Waal, or it may be drawn directly from the latter river by means of a sluice near Dalem, a steam pump and sluice near Vuren, and another sluice at the same place. The first has three openings, each 18 feet wide, and the second has a width of 12 feet, while the level of the third is so high that it is of but little use. The average level of the river at Dalem is 21″, and at Vuren 36″ above the inundation level, so that it will generally be easy to flood this basin, but in times of great drought it may be necessary to use the canal from Tiel to the Linge, mentioned above. With regard to the time required to flood this section, it is now considered certain that, owing to the late improvements, the inundations could be always prepared in time to meet an attack.

Fortifications.—The first approach to be guarded is that formed by the Lek and its southern dyke; this is covered by two forts, Everdingen and Spoel

[1] Wijk-bij-Duurstede is 30 miles, as the crow flies, from the nearest point of the frontier.

This canal is not open, though it is completed with the exception of the cuttings through the dykes of the Waal and the Linge. Its bottom breadth is 35 feet.

which, however, lose much of their defensive value by the existence of the embankment of the railway near Culenburg,[1] which is distant 2,600 yards from the former, and 1,500 yards from the latter fort. To obviate this disadvantage, as also to guard the railway bridge across the Lek, it has frequently been proposed to erect a fort at Culenburg, but as yet nothing has been done.

Fort Everdingen stands on the point of junction of the Lek dyke and the Dief dyke, and is an irregular earthen redoubt, with a wet ditch and a bomb-proof *réduit*. It might from its position, 1,800 yards in advance of Honswijk, to some extent guard the approach to the latter, were it not that the northern Lek dyke, acting as a traverse, completely shields an enemy, who may advance along its northern side. To the south of Everdingen are three emplacements, each for three guns, of which the most distant is about 760 yards from the fort.

Fort Spoel is intended to cover the sluice which lies in front of it, and consists of a small earthwork, of which only the northern half appears to be provided with a wet ditch, but the inundation would no doubt cover the ground as far as the counterscarp of the southern portion.

About 11,000 yards to the south of Everdingen lie the important approaches offered by the proposed railway from Dordrecht to Nijmegen, and by the river Linge and its dykes.

To guard the former an earthen battery is proposed, if not made, *on the Dief dyke*, at the point where it is crossed by the railway; it will serve also to defend some ground in its front which cannot be inundated, and to defend with its fire any portions of the Linge dyke which, owing to the windings of the latter, cannot be seen from

Fort Asperen, a semi-circular redoubt, with a bomb-proof barrack and a wet ditch, which, standing between the dykes of the Linge, can defend the course of the river; in this task it is assisted by a battery on the other (the southern) bank, which also covers the sluices which are there situated.

At a distance of 1,500 yards to the south of Asparen lies, or will lie, the *Fort on the Nieuwe Steeg*,[2] with a bastioned trace and with bomb-proof accommodation; this is intended to protect the southern Linge dyke, in the same manner as the battery on the Dief dyke covers the northern.

The next line of advance for an invader is offered by the Waal and the Merwede; this is covered on the north bank by Gorinchem, or Gorcum, a battery at Dalem, and a fort at Vuren.

Gorcum is a fortress of considerable size, of which the defences consist of nine bastioned fronts towards the land, and some irregular lines on the river, while the fronts facing east have some small outworks; but the lesson taught by the war of 1870 causes reasonable doubt as to its possessing any considerable power of resistance against an attack by modern artillery, if only because its ramparts enclose a large town. It contains some bomb-proof accommodation, and this is to be both augmented and improved. In addition to its task of guarding the Merwede, it is also intended, in case of the loss or abandonment of the land of Altena, to form a *point d'appui* for the right flank of the water-line.

The battery at Dalem is about 1,000 yards in advance of Gorcum, and 2,700 yards yet further to the east stands

The *fort at Vuren*, an earthen redoubt, with a wet ditch, and a tower which serves as a bomb-proof. This fort has been of late years much improved and enlarged, and occupies a strong position on the northern dyke of the Waal. These two defences serve to cover the river, the dykes, and some inundation sluices which lie near them.

[1] Or Kuilenburg.

[2] New Lane. These defences are to be completed during 1882.

3. *The Section between the Waal and the Maas.*

This section extends across the Bommeler-Waard, or island of Bommel, and is intended to serve as an advanced position in front of the right flank of the water-line.

Inundations.—The level at which this district would be flooded is A + 20″, and even then much of the country would remain dry: this would be more especially the case on the north and south edges, where the ground is higher, and is either arable, garden, or woodland, whereas in the centre, being pasture and polder land, it is lower. Since the average level of the Maas is only 2″ above the inundation level, it is evident that the water required to flood this section must be taken as a rule from the Waal, which at Vuren is 16″ above that level; but again the canals and ditches all communicate with and drain into the Maas, so that it can never be easy to arrange an inundation from the higher river.

Fortifications.—This section is defended by *Fort Loevenstein*, an old-fashioned quadrangular fortification, of which three of the fronts have a bastioned trace, while the river face is broken up into two small fronts; it has a wet ditch, beyond which is a counter-guard covered again by its own ditch, and flanked from small re-entering places of arms; it has no bomb-proof cover, except such as may be afforded by an old citadel.

It is intended to serve as an advanced work to Gorcum and Worcum, and to prevent the attack of Vuren from the south bank of the Waal, which is here about 600 yards in breadth. It is itself covered by two batteries, each provided with bomb-proof accommodation, which stand on the edge of the inundation, at a distance from Loevenstein of 3,000 and 4,000 yards respectively.

4. *The Section to the South of the Merwede.*

Inundations.—These are divided into two basins, separated from each other by the road from Geertruidenberg to Worcum.[1] They have each an inundation level of A + 27″, and differ from each other only in the source from which the necessary water is obtained.

That for the first or eastern basin is drawn from the Maas, through a sluice near Worcum, and since the river level at that place is from A + 57″ to A + 58″, the supply is at all times sufficient.

The second basin is inundated by opening, during the flood-tide, a sluice on the Bakkerskil, an arm of the Merwede, in which the tide rises to A + 55″, and thus yields an ample supply of water. Precautions, too numerous to mention here, must be taken with regard to the piercing of intervening dykes, and to the closing of retaining sluices; it is further to be noticed that the high road forming the boundary between the basins must be in some parts raised, or, being overflowed by the inundations, it will not be available for the use of troops retiring from Geertruidenberg or Worcum.

Fortifications.—Of these the largest is *Wondrichem* or *Worcum*, a fortified town on the Merwede, at the point where that river is joined by the Maas; this fortress is quadrangular, with one side parallel to the river; the three land fronts are traced on the bastioned system, and have wide wet ditches, while the river front has no ditch, and is little more than a straight parapet. In advance of the southern and eastern fronts are two ravelins, through which roads enter the town. There is no bomb-proof accommodation for troops, and the defensive power of the fortress, for the same reasons as those mentioned with regard to Gorcum, would probably not be very great. It is intended to guard the Merwede, the Waal, and the Maas, and also to assist by its fire in the defence of the approaches to Gorcum.

[1] Opinions, however, differ as to what should form the boundary between the basins.

Fort Giessen lies outside the inundations, and is distant about 2,700 yards from the most southerly battery in the Bommeler Waard, from which, however, it can receive, and to which it can render but little assistance, owing to the fact that the high dykes of the Maas intervene between them. It is to be completed during the present year, and has the trace of a redoubt with two faces, two flanks, and a parapet which closes the gorge; the ditch is wet, and there appears to be in it at present no bomb-proof cover. It serves as an advanced work to Worcum, and protects the southern dyke of the Maas.

About 7,000 yards further to the west stands *the fort on the Uppel dyke*, which is of considerable size, and has a modified bastioned front on its southern face, with two short flanks and a gorge parapet. The ditch is wet, and there is a small bomb-proof *réduit* in the centre of the gorge. It is intended to cover the high road on which it stands, and also the dyke from which it takes its name.

The fort on the Bakkerskil lies about 1,800 yards to the south-west of that mentioned above, and serves to guard the channel and the dyke along it, as well as the inundation sluice which is situated about 200 yards further to the southward; it has a long face and two short flanks, while the gorge is partially closed by a defensible barrack.

The fort on the Steurgat, also a branch of the Merwede, was commenced in 1880, and is to be finished this year. It is a pentagonal redoubt with a wet ditch, and, standing about 3,000 yards from Bakkerskil, is intended to defend the New Merwede and its dyke, and thus to guard the right flank of the water-line against a turning movement from the west.

It has been already mentioned that it is probable that an invader will endeavour to neutralize the inundations, either by drawing off the water and thus making them fordable, or by letting fresh water in until they become navigable. The former process, as regards the new water-line, is scarcely feasible, since all the inundations rest on dykes which lie behind the line of forts; even where such a plan is possible, as for example:

(*a*) No. 1 basin of the 1st section may be tapped by piercing the sea-dyke between Muiden and Naarden;
(*b*) Many basins can be drained into contiguous basins of lower level;
(*c*) If the Waal be low, the inundations may be drawn off into it by cutting the dykes;
(*d*) With regard to No. 2 basin of No. 4 section, as it is filled by opening a sluice at flood-tide, so it may be drained by opening it only at the ebb;

it is still possible to supply fresh water; should the enemy attempt to carry out the second expedient, the surplus water can always be allowed to escape through the numerous sluices in the retaining dykes.

Telegraphic communication will be shortly possible between all the forts in the water-line, and throughout the whole length there are good paved and gravel roads available for the movement of troops; but means of passage across the large rivers are much needed; for example, there is but one bridge (of boats at Vianen) across the Lek in rear of the line, and though it is proposed, in case of war, to throw a boat-bridge over the Waal, yet at present that river can be crossed only by ferries. There is a bridge on the Linge in rear of Fort Asperen.

The only line of railway in rear of the water-line is that from Utrecht to Amsterdam, so that if troops are to be moved from the former city to Naarden, they must be first carried to the capital. It is suggested that a line should be made from Utrecht to Gorcum to aid in the defence of the southern sections, while a cross-line from Abcoude to Weesp would do away with the necessity of the *détour* mentioned above.

It is further stated in the work from which this paper is mainly drawn[1] that some position in rear of the line is much needed for the purpose of there assembling and organizing large bodies of troops either for offence or defence. The ground is so low and damp as to be quite unsuited for this purpose, and it was at one time proposed to buy land and raise it artificially to a sufficient height; but this costly project appears to have been abandoned.

If the invaders should succeed in dislodging the defenders from the water-line, the latter will fall back upon the position of Amsterdam; this retreat will be made under most favourable circumstances, for its direction lies through a country almost entirely composed of polders, in which therefore only the dykes will be available for the advance of the enemy, who would thus be forced to move on a narrow front, so that the defenders would find many opportunities of delaying his march. This retarding action of the defence is yet again facilitated by the fact that the ground falls from the water-line towards the west, so that it may well be possible to draw off the water from an inundation, which has been crossed or turned by the enemy, into some fresh basin in rear of the former. In this manner a succession of lines may be held, and the ground may be disputed foot by foot.

The Position of Amsterdam.

Amsterdam, the commercial, as the Hague is the political capital, has been selected as the site of the Dutch national citadel and last defence, and is intended, not only to afford the opportunity of continuing the struggle for independence after the fall of the New and the South Water-lines, but also to be in a condition to resist an invasion which, coming from the sea, may strike directly at the heart of Holland without encountering any previous obstacles. If no other reasons existed for the selection of Amsterdam for this honour, such a choice is compelled by the fact that this city is the true centre of Dutch nationality, but it is also the best possible position for defence from both a military and a naval point of view.

As a naval station, it has dockyards and arsenals, and further possesses communications with the sea by way either of the Zuider Zee, or yet more conveniently by the North Sea Canal, which has a depth of nearly 23 feet, and will thus allow of the passage of vessels of considerable size. As a military position it is probably one of the strongest sites in the world, since the ground around it is so low[2] that the polder system is here carried out to the greatest extent, and inundations can therefore be made everywhere with ease, more especially since the sea is always available as a source of water. The country also, even when not flooded, is so intersected with ditches and canals, that the movement of bodies of troops would be impossible except along the roads; while it can be at any time inundated by merely stopping the hundreds of pumps (wind and steam) which by incessant working contrive to keep the ground comparatively dry. Again, the character of the soil is such, being nearly all sand and peat, and the water stands at all times so near to the surface, that the besieger would be obliged to bring from a distance such earth as he would need for the construction of his batteries, &c. So absolute is this necessity, that within the position stores of earth have been accumulated for the purpose of therewith constructing the defences.

The general principle which has guided the plan of the inundations around Amsterdam is to place the outer edge of the inundations at such a

[1] "Militaire Aardrijkskunde en Statistiek van Nederland," door M. Plantenga, Kapitein der Infanterie.

[2] In most parts below the level of the sea.

distance from the capital as shall secure the latter from bombardment, while the inner edge shall lie at a sufficient distance from the city to allow of space for camps, hospitals, &c., as also for the pasturage of cattle for the use of the garrison.

The actual details of the inundation around Amsterdam are as yet undecided, and the whole system of defence will undergo such great changes that it is not possible as yet to say what will be the eventual result.

It has therefore been held advisable to divide this portion of the paper into three parts, viz. :—

I. The defences of Amsterdam, as they exist at present, with corresponding inundations.[1]
II. The defences and inundations proposed in 1873.[1]
III. The defences proposed in 1881.[1]

I. Under the existing system the inundations can be best considered by dividing them into three sections, namely :—

1. The North Front.
2. The West Front.
3. The South Front.

And these will be taken in order with the defences of each.

1. *The North Front*

extends from the Zuider Zee to the northern dyke of the North Sea Canal. It is divided in five basins, of which space will not permit the exact boundaries to be given.

The first basin extends from the Zuider Zee to the North Holland Canal. It has an inundation level of A – 15″, and is flooded by stopping thirteen windmills and a steam pump, and by letting in water from the canals ; if this is not sufficient, sea-water can be supplied from the Zuider Zee through a sluice near Monnikendam, or brackish water from the North Holland Canal. The water cannot be drawn off by the enemy, but he can raise its level with the view of making the inundation navigable, by letting in water from the Zuider Zee, which water, however, the defenders can drain off into the North Holland Canal, or can expel by again working the mills and pumps.

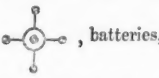
The second basin is filled by stopping the five mills and a steam pump which drain it, and with water from the North Sea Canal. This basin is divided from the first because it can be drained with less difficulty than the latter, though it lies lower, and may be made navigable by running the water of the first basin into it. But the defenders have always the power to drain it by the North Sea Canal.

The third basin has an inundation level of A – 15″. It is filled in the same manner as the second. It is difficult to drain, and the enemy would gain little by drawing off the water, while it is almost impossible to make it navigable.

[1] These are distinguished on the map as follows :—

I. Forts , batteries, &c. ●

Inundations, parallel lines, thus

II. Forts  , batteries, &c. ✕, connected by a dotted line.

Inundations, parallel lines, thus

III. Forts and batteries as in II, but connected by a chain dotted line.

The ground marked by both horizontal and vertical lines is included in both systems of inundation.

The fourth basin has an inundation level of A – 20″. In order to fill it the mills are first stopped, and if this is not sufficient, water is let in from the canals. The inundation cannot be drawn off, as what lower ground there is has but a small area, and it can with difficulty be increased in depth.

The fifth basin has the same inundation level as the fourth, and is inundated by stopping the mills, and by letting in water from the North Sea Canal.

Fortifications on the North Front.

The first approach lies along the sea-dyke of Monnikendam and has practically no defences, since Post No. 11[1] is a battery of no great value, while Post No. 12 is little more than a mound of earth, and the battery by the Kinselmeer exists only on paper, having been washed away in 1825. There is, however, a store of earth at Durgerdam, and in 1870 it was proposed to build a fort on the Ijdoorn, as also another in the Kinsel polder which should defend the inner side of the sea dyke.

Passing westwards we come next to No. 3 Post, which is described as "intended for a battery;" No. 2 Post, a work partly made in 1868; and No. 1 Post, which is little but a supply of earth.

There are, in fact, at the present moment no defences on the north front of Amsterdam, but forts were in 1870 proposed, in the positions shown in the map, in the Achtersluis Polder, and on the railway bridge over the North Sea Canal, for the purpose of guarding the latter.

2. *The West Front.*

Inundations.—The ground in this direction is not so low or so intersected as is the northern front, yet it would be at all times exceedingly difficult to pass.

The inundations are divided into five basins: the first basin is filled by shutting the outflow sluices, stopping the pumps, and letting in water from the North Sea Canal; the inundation level is A. A second line of inundation can be formed further to the rear from the same source.

The second basin has a level of A – 12″. Little water can be gained by stopping the pumps, and what is needed must be drawn from the streams which connect the basin of the Old Rhine with the North Sea Canal, which must be reinforced by shutting all the sluices which allow of the flow of water westwards, or of its escape to the sea.[2]

The third basin lies behind the second, and has an inundation level of A – 17″. It is flooded in a similar manner to that used for the second. When the latter has been emptied by the enemy, the third basin can be drained into it, but fresh water can always be let in by the defenders.

The fourth basin has the same level, and is filled from the same sources, as the third. The fifth basin is inundated to a level of A – 39″, and is filled in the same manner as the second, third, and fourth, from the basin of the Rhine; but in this case it is necessary, failing waterways, to pierce the dykes between the polders.

The grave question, which has much exercised the minds of the Dutch, as to whether the huge Haarlem polder shall be inundated, it is proposed to discuss on a later page.

Fortifications.

(*a*) *The position at Spaarndam* is intended to guard the approaches and bridges which exist there, but the defences which compose it, namely Posts

[1] *See* Map I.

[2] This is a mere outline of a most complicated question, but space will not admit of more detail.

Nos. 3, 4, and 5, are nothing more than mounds of earth, and of no value whatever.

(*b*) *The position on the Liede.*—Of the fortifications in this line, Post No. 2 is a redoubt with flanks and an open gorge covering the old Haarlem road, and was partially repaired in 1868; Post No. 1 consists of two small open batteries made in 1868, and is intended to guard the canal, the road, and the railway; while the fort on the Liede is a masonry tower[1] of about 25 feet in height, encircled, but not shielded, by a low parapet; the last stands on an island in the canal which surrounds the Haarlem polder, and is intended to defend the latter with its dyke, and the railroad from Haarlem to Amsterdam.

(*c*) *The position at Halfweg* includes Post No. 6, which consists of two earthworks beside the railway, and Post No. 7, a small open battery; neither of these has at present any defensive value, though the latter was partially repaired in 1868.

(*d*) *The position between Halfweg and Schiphol.*—Of these Post No. 11 is in ruins; and the forts on the Nieuwe Meer and at Schiphol quadrangular earthen redoubts with brick *réduits*, though in moderate repair, are of no great strength.

3. *The South Front.*

Inundations.—The ground in this section consists of a chain of small polders, very marshy and low, and is intersected by many wide canals.

The section is divided into six basins; part of the first basin lies so low that if the pumps be not kept continually at work it will at almost all times be under water, and it is thus evident that, when the inundation has been made, the pumps must still be always in readiness lest the water may become navigable; again, new pumps must be made for this purpose, since those now in existence stand on the outer edge of the line, and may thus pass into the power of the enemy. The inundation level is for the former part A – 157″, for the rest A – 51″. If owing to dry weather the stopping of the pumps be not sufficient to form an inundation, water can be drawn from the Amstel river.

The second basin has an inundation level of A – 55″; water is obtained for it from the same sources as for the first.

The third basin is inundated at two levels, the water in one part standing at A – 118″, in the other at A – 47″. Water is obtained as before by stopping the pumps, and if necessary from the Amstel and Vecht.

The fourth basin has an inundation level of A – 47″, and is flooded in the same manner as those before mentioned. It is considered by some that it would be wiser to keep it dry, as it is the kitchen-garden of Amsterdam.

The fifth basin is inundated at a level of A – 39″; the water is obtained by stopping the pumps, and also from the Vecht and the intersecting canals. It may be made navigable by letting in water from the former, but this may easily be drawn off through the latter.

The sixth basin extends to the Zuider Zee, and has an inundation level of A – 39″; it is flooded by stopping the pumps and with water from the Muiden Canal. If an attempt be made to render it navigable by letting in water from the Zuider Zee, this can be run off by the rear of the line.

Fortifications.

(*a*) *The position of Amstelveen* consists of two posts, both ordinary earthen batteries with open gorges: they are numbered 13 and 14, and were partially repaired in 1868.

(*b*) *The position of Ouderkerk* was also improved in that year, and includes

[1] It is proposed to remove the tower.

Post No. 12, a redoubt with two short flanks; Post No. 11, and Post No. 10, which each consist of two open batteries.

(*c*) *The position on the Utrecht road* comprises a fort in the Laander polder which is quadrangular and of four bastioned fronts, with a wet ditch, but has no bomb-proof cover; it serves to defend the railway and road. Post No. 9, an earthen battery, stands in advance of it, at a distance of about 1,500 yards. Post No. 8 on the Gein is in ruins.

(*d*) *The position on the Sneep* includes four batteries, namely: Post No. 18, which is entirely open; Posts 20 and 21,[1] which are merely mounds of earth; and Post No. 19, which is little better; Post No. 22, a little nearer to Amsterdam, is out of all repair.

(*e*) *The position of Diemerdam* consists of four posts, namely: Post No. 6, an open battery, and Posts Nos. 3, 4 and 5, which are in absolute ruins.

It is evident from the above that the existing fortifications around Amsterdam have no defensive value whatever, while the inundations are not considered to be sufficiently advanced, as regards their position, to fulfil the object of the protection of the city from bombardment.

II. In 1873 the following lines were suggested.

Inundations, such as are marked in lines on the map, having on the inner edge a length of nearly 62 miles, and being at no point less than 4 miles from Amsterdam.[2]

Fortifications.—These are divided into two parts, of which one is North, and the other South, of the line formed by the Ij and the North Sea Canal.

1. The Northern Section, commencing at the Zuider Zee, we find—

(*a*) Some works on the sea-dyke near Uitdam.
(*b*) A post to the north, and another to the south of Monnikendam.
(*c*) A fort north-east of Edam.
(*d*) A fort on the eastern dyke of the Beemster polder.
(*e*) A fort on the southern dyke of the same.
(*f*) A fort near Knollendam.
(*g*) A fort on the railway, between Uitgeest and Krommenie, with
(*h*) A post behind the St. Aagten dyke, and in front of the Krommenie dyke.
(*i*) A post on the new dyke.
(*j*) A fort between the Wijker meer (or lake) and the Wijker brook.
(*k*) A fort at Velsen.
(*l*) A fort at the mouth of the canal.[3]

Total—eight forts and six posts: all these to be new works.

2. The Southern section, beginning at the West:—

(*a*) A fort in the Buitenhuizer polder.
(*b*) A fort behind Spaarndam.
(*c*) A post on the Penningsveer (No. 1 Post of the old line).
(*d*) The fort on the Liede, with a post behind the Liebrug (Post No. 2 of the old line).
(*e*) A fort at Halfweg, with a lunette (Post No. 6 of the old line).
(*f*) A work at Polanen.
(*g*) A fort at the Nieuwerkerker hoek.
(*h*) A work at Sloten.
(*i*) The fort on the Nieuwe Meer.
(*j*) Fort Schiphol.

[1] Not marked in the map.

[2] It is useless to give the details of these inundations, consisting as they would principally of the names of polders, of which the boundaries cannot be shown on the map.

See page 750.

(*k*) A fort on the Oosteinder dyke.
(*l*) A fort at Amstelveen.
(*m*) A fort on the western dyke of the Bovenkerker polder.
(*n*) A fort on the eastern dyke of the same.
(*o*) A battery at Nestersluis.
(*p*) A post at Vredelust.
(*q*) A work at Botshol.
(*r*) A work at the outer end of the Groenlandsche Kade.
(*s*) A work at the Bambrugsche Zuwe.
(*t*) A work at the Demerik water-mills.
(*u*) Fort Nieuwersluis and the battery at the railway station.

Of these (*c*), (*d*), part of (*e*), (*i*), (*j*) and (*u*) are old works. Total (not including Nieuwersluis, since that forms part of the water-line), 11 forts and 11 small works. Grand total—19 forts and 17 posts and batteries.

Coast batteries were also proposed, to be built on the dykes of the Ij, with the object of forbidding its access to hostile vessels.

III. The line of fortifications proposed in the estimates for 1881 was as follows:—

1. On the Northern front, commencing at the Zuider Zee—
(*a*) A fort at Edam.
(*b*) A post on the railway from Zaandam to Hoorn.
(*c*) A fort on the east dyke of the Beemster polder.
(*d*) A fort on the west dyke of the same, and on the North Holland Canal.
e A fort at Spijkerboor.
(*f*) A fort on the Stierop.
(*g*) A fort near Uitgeest.
Total—six forts and one post.

2. On the Western front—
(*a*) A fort near the Wijker brook.
(*b*) A fort at Velsen.
(*c*) A fort at Spaarndam.
(*d*) A post on the Penningsveer (old line).
(*e*) A fort on the Liede (old line).
(*f*) A fort at Vijfhuizen.
(*g*) A fort at Hoofddorp.
(*h*) A fort at Alsmeer.
Total—seven forts and one post.

3. On the Southern front—
(*a*) A fort between Kudelstaart and Kalslagen.
(*b*) A fort at Uithoorn.
(*c*) A fort at Nestersluis.
(*d*) A fort at Stokkelaar's brug.
(*e*) A fort at Abcoude.
(*f*) The existing works on the Gein to be repaired and improved.
Total—five forts. Grand total—eighteen forts.

In order to complete this account of the inundations, it is necessary to say a few words as to the Haarlem polder. This, which up to the year 1840 was a lake, was drained at great expense[1] by works which continued until 1853, and is now in a state of high cultivation. Like other polders it is surrounded by a dyke, along which runs a canal, into which the surplus water of the polder is pumped by steam-engines. It has an area of about 72 square miles, and a population of about 10,000, so that there is naturally much

[1] 1,125,000*l*.

hesitation as to its inundation, even in time of war. Again there is some difficulty as to the supply of water: unless the weather be peculiarly wet, enough cannot be gained by stopping the pumps; the next resource is to draw it from the Rhine basin, but this will not suffice unless it be itself fed, which cannot be done except with brackish water; as a last resource sea-water may be let in from the North Sea Canal, but this will imply the loss, partial or total, of several harvests, of which each is worth 250,000*l*.

If to this sum we add the cost of re-draining the lake, it is easy to realize the hesitation of the Dutch to destroy this wonderful work; yet if it be not flooded the enemy can advance in it, and should he succeed in piercing the northern dyke, can draw off the water from the very narrow inundations beyond it, and thus pierce the line.

It is probable that a dyke will be made across the polder on a line through Hoofddorp and Alsmeer, and that the northern portion only will be inundated, but this plan is liable to the objection that the enemy, by piercing this dyke, can draw off the water from the inundation and thus make it fordable.

With regard to the general plan of the fortifications it is intended that the existing defences shall be retained in rear of those now proposed, in order to form a second line, should such be needed. The new works are to be proof against a *coup de main*, to have bomb-proof cover for guns, ammunition, and garrison, and are to be armed with heavy artillery.

It must further be remembered, with reference to the defence of Amsterdam, that much assistance will be given by gunboats and monitors on the canals, while the care of the Zuider Zee and of the entrance to the Ij is, under the new scheme, handed over altogether to the navy.

There is one great difficulty to be surmounted in the case of a siege of Amsterdam: the population is about 317,000, and we may assume that the garrison will be at least 50,000; yet for these there is no drinking-water in the city, for the Amstel and the canals are not only rendered brackish by the tide, but are tainted with sewage. The city is at present supplied with fresh water from the dunes near Haarlem, but at the very commencement of a siege that source may be cut off.

A supply of water can be obtained from the Vecht, at least until the enemy has pierced the water-line, but as soon as he approaches Nieuwersluis no water can be drawn from above that fort, while below it, the stream is frequently so brackish as to be undrinkable.

The Lines in Advance of the Water-line.

These are two in number, namely:

(1.) The line of the Eem and the Grift, commonly called the Grebbe line with a small section across the Betuwe between the Neder-Rhine and the Waal;

(2.) The line of the Gelder Ijsel;

and are intended, as before mentioned, to be held as advanced lines, with the object of delaying the enemy's march, and of thus giving time for the concentration and organization of troops, as also for the formation of the inundations.

1. *The Grebbe Line.*

This position extends from Spakenburg, on the Zuider Zee, along the Eem to Amersfoort, and thence by the Grift to de Grebbe on the Neder-Rhine; it is further prolonged to the Waal by a line from Spes to Ochten. It has a total length of about 26 miles, and is distant from the Gelder Ijsel about 30 miles, from the water-line in the north 9 miles, in the centre and south about 15 miles.

(*k*) A fort on the Oosteinder dyke.
(*l*) A fort at Amstelveen.
(*m*) A fort on the western dyke of the Bovenkerker polder.
(*n*) A fort on the eastern dyke of the same.
(*o*) A battery at Nestersluis.
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The Lines in Advance of the Water-line.

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(1.) The line of the Eem and the Grift, commonly called the Grebbe line with a small section across the Betuwe between the Neder-Rhine and the Waal;

(2.) The line of the Gelder Ijsel;

and are intended, as before mentioned, to be held as advanced lines, with the object of delaying the enemy's march, and of thus giving time for the concentration and organization of troops, as also for the formation of the inundations.

1. *The Grebbe Line.*

This position extends from Spakenburg, on the Zuider Zee, along the Eem to Amersfoort, and thence by the Grift to de Grebbe on the Neder-Rhine; it is further prolonged to the Waal by a line from Spes to Ochten. It has a total length of about 26 miles, and is distant from the Gelder Ijsel about 30 miles, from the water-line in the north 9 miles, in the centre and south about 15 miles.

The character of the country in the northern part of the line is favourable to the defence, being low, marshy, and much intersected with ditches, &c.; but to the south of Amersfoort this character is entirely changed, for the ground there becomes sandy and commences to rise, and is further covered with woods; yet more to the south the country again becomes low and difficult, while on approaching the Neder-Rhine, the soil changes from sand to clay, and so continues as far as the Waal. The level of the ground falls from A+23 feet at de Grebbe, to A −8 inches on the Eem, and it is therefore necessary to form the inundations in ten separate basins.

Space will not admit, and the line is not of so great importance as to require, a detailed statement of these inundations, and it may be sufficient to say that the largest basin, that in the north, is flooded from the Zuider Zee, while for the others, the required water is obtained by damming up the small rivers and brooks, and from the Neder-Rhine by way of the Grift. The formation of the inundations must therefore be a very slow process, and it is more than probable that, except in extraordinarily wet weather, they would not be completed until too late, or would be inadequately formed, at least in front of the centre of the line.

On account of this scarcity of water, there is but little fear that the enemy will be able to make any of the basins navigable, while he will derive but small advantage from draining them, since the time required for that operation would probably be greater than the period during which it is intended to defend the line.

The section between the Rhine and the Waal is flooded by damming the Linge, which has, however, at this point only a small quantity of water; but the importance of this disadvantage is much lessened by the normal character of the ground, which is so flat, open, and intersected, that even without inundation it is capable of easy defence.

Fortifications.—At Spakenburg, on the Zuider Zee, the approaches against the extreme left of the line are covered by a square redoubt within the sea dyke, by two embankments on the dyke, and by a battery to the west of the harbour.

Further to the south lies the Grebbe line itself, a low earthen parapet, strengthened at various points by works, either in or in front of the line.

These are all earthworks of various sizes and traces, and cover the different approaches to the line from the east, and of them the principal are:

At Eembrug—a proposed post.
At Krachtwijk—a front with barbettes in the line.
On the Koelhorster Kade—a proposed work.
On the Glashut—a front similar to that at Krachtwijk.
At Asschat—an advanced work, with a demi-bastioned front and an open gorge.
At Roffelaar—three small irregular works.
Fort Daatselaar—an isolated work of considerable size, with an irregular trace.
On the Lambalge bridge—a small lunette.
On the Engelaar—a front of about 300 yards in length.
The Fort on the Buursteeg—a large hornwork. In rear of this stand a battery and a lunette on the railway.
On the Roode Haan—a small flèche.
At de Grebbe—a hornwork, three bastioned fronts, and a battery, the length of the whole line being about 1,500 yards.
At Spes and Ochten—two small works with wet ditches, connected by a line of parapet which is provided with occasional emplacements for guns.

The line is, as a whole, exceedingly defective; the inundations, as has

been mentioned, are uncertain, many of the approaches are not in any way defended, and the great majority of the existing fortifications are in such a ruined condition as to be of little or no value as defences. The Grebbe line itself, for instance, is at best merely a breastwork with a parapet scarcely 6 feet in thickness, while the barbettes which exist at intervals along it have a terreplein of only about the same width; at its worst, it has almost disappeared, and at some points is not even of sufficient height or strength to serve as a boundary to the inundation. Its ditch is partly filled up, partly overgrown, and the ground in front of it is so well provided with cover, that in many places an attacking force could advance unseen to within 100 paces of the line.

Money has been frequently demanded from the States-General for the repair and improvement of this defence, but has been always refused by the Second Chamber. In 1873, a sum of 136,000*l.* was asked for for this purpose, and again in 1880, improvements were suggested, but in each case were met with the statement that the military importance of the line and its *rôle* in time of war did not justify so great an expenditure.

The communications in rear of the line are excellent, since there are a great number of roads and three railroads, to which a fourth is shortly to be added. The ground behind the line is high, and well suited for encampments.

2. *The Line of the Gelder Ijsel.*

This river is defended by series of bridge-heads at the principal points of passage, namely :—

(*a*) At Arnhem.
(*b*) At Doesburg.
(*c*) At Zutfen.
(*d*) At Zwolle.

These defences are intended to delay the passage of the river by offering so much resistance that the enemy shall not be able to cross until he has closed up a considerable force to the front.

The military value of such a line and of such a system has been much disputed, and in the estimates of the present year the Minister of War proposes to abandon the use of Doesburg as entailing an unnecessary expense.

(*a*) At Arnhem. *Fort Westervoort*,[1] a quadrangular earthwork of which the front face has a weak bastioned trace, stands on the western bank of the Ijsel, and defends the railway bridge which crosses the river at that point.[2] The railway runs through the centre of the fort, which has a wet ditch, and two bomb-proofs each of four casemates; the armament consists of 12 guns and 12 howitzers, and the garrison in war would be about 500 men. In 1880 the fort was improved by raising the front parapet, and batteries are now being made near it, behind the dykes of the Rhine and the Ijsel.

(*b*) At Doesburg. At this town, which is about 9 miles from Westervoort, is a *tête de pont* on the right bank of the Ijsel. The works consist of two lines, the high and the low line, which together enclose the town towards the east at a distance of about 600 yards; the left of the line is covered by a quadrangular work, Fort Bretagne; the right by a hornwork, de Vrijheid. All the works have wet ditches, but no revetments, covered way, or glacis.

(*c*) The fort at Zutfen, and (*d*) that at Zwolle, have not at present been commenced, nor does it appear probable that any such forts will be built, as the Minister of War decided in 1879 that the necessity of making such works bore no proportion to their probable cost.

[1] *See* Map No. III. No. 23, plate of forts.
[2] The river is about 200 yards in width.

We may therefore conclude, since Westervoort is the only work on the line which is to be garrisoned, that the defence of the Ijsel will be limited to the destruction of the bridges, and to the protection of probable points of passage by the field army.

In connection with this line it may be well to mention the forts on the Upper Waal,[1] which form a prolongation of it.

These are—

(1) Fort Pannerden,
(2) Fort Kraijenhoff, and the forts above and below Lent,

and are intended to guard the river.

(1) *Fort Pannerden*[2] stands on the dam between the Pannerden Canal and the Waal, and serves to forbid the passage of boats up the river, and also to prevent any attempt to turn the water from the Waal into the canal or *vice versâ*.

It is a brick fort and is furnished on the Waal front with five Haxo casemates, which are eventually to be fitted with iron shields; it has also bomb-proof cover for the garrison, and is sheltered by a glacis with a small covered way. It is armed with 40 guns and mortars, including two howitzers in caponiers, six 6″ guns on the Waal front, and five on that of the Pannerden Canal, and three 9″ mortars. Its garrison in time of war would consist of about 350 men.

(2) *Fort Kraijenhoff* and the forts above and below Lent, are intended to defend the river and the railway bridge. The Minister of War, however, in the estimates of the present year proposes to abandon them as defences.

Fort Kraijenhoff lies on the dyke of the Waal, and is an irregular casemated work with a wet ditch; it has a bomb-proof *réduit*, and in front of it is a glacis and an advanced ditch. The most remarkable point about this fort is that it faces to the west, the eastern face being merely a brick wall which closes the gorge.

The fort above Lent is of very little value, being merely a small semicircular building enclosed by a ditch, into which water can be admitted, and by a small glacis and covered way; it contains seven 4·5″ guns and one mortar. It can receive no assistance from either of the other forts, but can be bombarded without difficulty at short ranges by the enemy.

The fort below Lent is an earthen redoubt with bomb-proofs, and is surrounded by a ditch which can be filled with water. It is the largest of the three works, but apparently faces north away from the river. It can give little assistance to Kraijenhoff, and not one of the three forts can really cover the railway bridge. There are two bomb-proof towers at the southern end of the latter, which are intended to ensure the defence of the bridge by the fire of infantry.

The Southern Water-line.

This may be conveniently divided into three parts, namely:—

1. The line of the Maas and Hertogenbosch.
2. The position of Heusden.
3. The position of Geertruidenberg.

Of these it is proposed to abandon the last and the greater part of the first, and to use the remainder as a guard for the Bommeler Waard, and as a refuge for any troops which may be driven in from the southward.

1. *The line of the Maas includes*—

(*a*) Fort Nieuwe St. Andries,

[1] *See* Map No. III.
No. 19 plate of forts.

(*b*) The fort on the Blaauwe Sluis, and
(*c*) Fort Crèvecœur.

The first[1] is a pentagonal redoubt with a masonry keep; it is surrounded by a wet ditch, beyond which on the west side are a few outworks. The fort stands behind the St. Andries Canal, which connects the Maas with the Waal, and serves to guard the adjacent sluice, and to forbid an entrance into the Bommeler Waard.

(*b*) *The fort on the Blaauwe Sluis*, which is a bastioned work with a wet ditch, a masonry *réduit*, and a loop-holed gorge wall, is to be dismantled. It stands on the left dyke of the Maas, and serves to guard the dyke and the river.

Fort Crèvecœur[2] is a very large bastioned fort, which is surrounded by a wet ditch, but has no bomb-proofs; it is intended to cover the retreat of troops retiring across the Maas by a bridge of boats to the north of the fort, and also to guard the sluices near it. Two batteries standing near Fort Crèvecœur on the railway are, by the present plan of the Minister of War, to be abandoned.

With regard to the position of Hertogenbosch,[3] it is intended to demolish the works which compose it, and it will therefore be sufficient to say that it consists of—

(1) A work at Herven,
(2) A fort at Ochten,
(3) Some works at Hintham,
(4) Fort Isabelle,
(5) Fort St. Anthony,

of which the three first are entirely out of repair, while the latter, of which (4) is a pentagonal bastioned fort, and (5) a crownwork with an open gorge, are old-fashioned as to their trace, and defective as to their profile. A fortified position at Vucht, which is defended by eight lunettes, and which lies to the south-west of Hertogenbosch, is also to be abandoned, in accordance with the desire of the Minister of War to concentrate the defence on the New Water-line.

The inundations of this section are divided into seven basins, of which

(*a*) Has an inundation level of A+13·5′, and is flooded by damming the Dommel and the Aa, two tributaries of the Dieze.
(*b*) With a level of A+10·5′, from the latter river.
(*c*) From the same source, with a level of A+12′.
(*d*) Also from the same source, with a level of A+12·3′.
(*e*) Is inundated from the Maas through the Roode and the Blauwe sluices; it has an inundation level of A+13′.
(*f*) Is flooded in the same manner as (*b*); level A+10·8′.
(*g*) Is inundated from (*f*) by cutting the dykes; it has a level of A+9·8′.

As it is very doubtful whether, unless much time be given, these inundations can, under ordinary circumstances, be formed, it has been proposed to make a reservoir at Well, on the Maas, for the purpose of supplying the necessary water; but since this portion of the line, with the exception of the river forts, is to be abandoned, it is very unlikely that any expense will be now incurred for the above object.

2. *The position of Heusden.*

The inundations of this section have a level of from A+4′ to A+5·5′ and

[1] No. 3 plate of forts.
[2] No. 7 plate of forts.
[3] Or "Bosch," as it is generally called.

are formed by damming the various canals which drain the land ; should this means, as is probable, prove insufficient, water must be let in from the Maas, which at Helein has an average summer-level of A+6′ ; the reservoir mentioned above would, however, much assist and accelerate the operation.

Fortifications.

(*a*) *The work on the Hedikhuizen Sluice*, an earthen lunette with a wet ditch and a closed gorge, intended to guard the above sluice, through which the water from the Maas passes to form the inundations.

(*b*) *The work on the Maas dyke*, a fair sized irregular earthwork, with a wet ditch and provided with bomb-proof cover and magazines ; it is used to defend the dyke from which it takes its name.

(*c*) *The work at the Bernsche Hoeven* is about 1,100 yards to the south-west of (*b*), and serves to cover a patch of ground near it which lies above the inundation ; it is a four-sided star-fort, with a wet ditch and bomb-proof accommodation.

(*d*) *The fort on the Elshout road*, a quadrangular earthwork, which also has a wet ditch and a bomb-proof ; it is intended to forbid the use of the road to an enemy.

(*e*) *The work behind the Elshout dyke*, which serves to defend that dyke and an adjacent sluice ; it is a small semi-circular redoubt, with a wet ditch and some bomb-proof cover.

(*f*) *The fort behind the Doevoren sluice*, a six-sided earthwork with a wet ditch and a bomb-proof magazine. It is about a mile behind (*e*), and defends the same dyke, as well as the sluice which gives it its name.

The battery on the Pruimendijk, used to cover the flank of (*f*) ; it is, however, entirely out of repair.

Heusden itself is an old fortress which might, perhaps, in case of necessity, give some little aid to the defence of this section.

Between the position of Heusden and that of Geertruidenberg lies the line of the Langstraat, but since there are at present no defences here, though two forts have been proposed by the Labbegat and at Waspik, it is not desirable to give any space to the description of the inundations of this section.

3. *The position of Geertruidenberg*

is to be abandoned according to the last plans of the Minister of War, and it will therefore be sufficient to say that the inundations were to be formed from two sources, namely, the Donge, a small river, and the Amer, a branch of the Merwede, and that the defences consist, in addition to Geertruidenberg itself, of an irregular fortress of eight bastioned fronts, of a position at Steelhoven, which is a similar front in entire disrepair, and of a lunette with an open gorge standing to the north-west of the town. To the west of this position, on ground which lies too high to allow of inundation, stand the lines, Van den Hout and Van den Munnikhof, each about 1,100 yards in length and traced *en crémaillère*, and the work at Terheiden, a four-sided bastioned fort with a wet ditch. All these works are in ruins, but it is possible that they may be repaired in connection with the proposed defences at Moerdijk, of which we must now speak.

Of the 600,000*l.* which the Minister of War proposes to save by abandoning so much of the Southern Water-line, a sum of 253,000*l.* is to be expended on the fortifications which are to defend the railway bridge across the Hollandsch Diep.

No distinct position appears to have been at present selected for these defences, but it may be interesting to examine the character of the various schemes suggested.

It was at first held that the bridge might be made useless by destroying a

span, but objections were made to this proposition that, apart from the enormous expense entailed by the subsequent repair, such destruction, if carried out at a too early date, would seriously hamper the communications and the retreat of any forces to the south of the Hollandsch Diep, while if delayed too long, the near approach of the enemy might render it difficult or impossible to execute.

A fort was then suggested at the southern end of the bridge, in such a position as might best defend it and also the northern shore from the fire of the enemy's guns. The bridge, it was said, could be at any time destroyed, as soon as the passage was no longer needed.

In 1880, a fort was proposed on the northern bank, where it was considered capable of protecting, not only the bridge, but also the Dordsche Kil, by which the enemy's vessels of light draught could pass to Dordrecht and the New Merwede, by which they could move on to the right flank of the New Water-line. This fort was to be placed at Willemsdorp.

But since this plan left the harbour at Moerdijk and that at the mouth of Roode Vaart at the mercy of the invader, it was decided that a fort must be built on a sandbank in the Hollandsch Diep to the north-west of Moerdijk for their protection.

Others again proposed that, in place of one expensive fort, a series of small works and batteries should be placed as a bridge-head, and that this position should be covered by inundations. In this manner the bridge, which from its great height is much exposed to fire, might be preserved from damage, since thus the enemy's artillery would be kept out of range.

Such plans have at various times been suggested, but until the present year no vote of money has been demanded for this purpose. It remains to be seen which, if any, of these systems may be adopted, but the preference appears to be given to that employing a bridge-head. In any case the lines before mentioned to the south of Moerdijk will probably be repaired and held as advanced posts, useful for the reception of troops retiring from the south or south-east.

The Coast Defences.

These consist of the following, namely :—

1. The Helder position.
2. The position of the Mouths of the Maas and the Haringvliet.
3. The position of the Hollandsch Diep, and the Volkerak.
4. The works on the West Scheldt.

To these may be added the works which are to be constructed to defend the western end of the North Sea Canal and the harbour of Ijmuiden. For this latter purpose money was demanded in 1879, 1880, and 1881, and in the last of these years the following scheme was proposed. That 24 c.m. (9·5″) guns should be employed, and that these should be covered by shields of Grüson metal,[1] in addition to an armoured turret armed with two 15 c.m. (6″) guns, the latter being in each case constructed of steel. Further to protect these from an attack on the land side, a position was to be made for infantry and for some machine guns.

Since by the late proposals of the Minister of War, (4) the works on the West Scheldt are to be abandoned,[2] it may be well to discuss these in a few words before proceeding to describe the others.

Ter Neuzen[3] lies at the mouth of the canal which runs between the Scheldt and Ghent. It is a small fortress, with wet ditches except on the northern

[1] A species of chilled cast-iron.
[2] And are therefore not shown on the large map.
[3] Map No. V.

side, built on the bastioned system, and strengthened with three ravelins. It has some bomb-proof accommodation for troops.

Ellewoutsdijk, which stands on the opposite shore of the Scheldt (here about 5,000 yards in width), is a hexagonal fort, with a wide wet ditch, and with bomb-proofs on the sea-front.

These are the only defences of any value, since of the others, Flushing been long abandoned as a fortress, while Breskens on the mainland, Fort Path, in South Beveland, are in ruins.

1. *The position of the Helder.*[2]

This is of the first importance in the scheme for the defence of Holland, since not only does it contain a good harbour, docks, arsenals, &c., but by its position commands the entrance to the Zuider Zee, and thus, so long as it is retained in the hands of the Dutch, prevents the possibility of the entire investment of Amsterdam ; but there is yet more to be said on the subject, for, since the circle of defence of the capital is divided into two parts by the North Sea Canal (which cannot be turned), an attack on the northern front is possible only in the case of a landing from the sea in that direction, and the latter may further be said to be feasible on the condition only of the capture of the Helder : it is the more necessary to guard against this danger for the reason that the coast between Ijmuiden and the Helder is of a character calculated to favour the landing of an enemy.

We find, therefore, that the Helder is fortified towards the land as well as towards the sea, the forts being as follows :—

Sea Defences—

(*a*) Fort Kijkduin.
(*b*) Fort Erfprins, and the Kaaphoofd Battery.
(*c*) The Oost (or east) Battery.
(*d*) The Prinses Louise Battery.
(*e*) The Wierhoofd battery.
(*f*) A fort at Harssens (incomplete).

Land Defences—

(*g*) Fort Dirks-Admiraal.
(*h*) Forts Oost and Westoever.

Forts Kijkduin and Erfprins can also assist in the defence of the land side, which is further aided by the lines of parapet which connect Erfprins with Dirks-Admiraal and the latter with Westoever.

(*a*) *Fort Kijkduin* stands on a sand-dune at a height of about 70 feet above the sea, and thus to a great extent commands the ground around it : where, however, cover is given by any of the other dunes, these last are to be cut away and lowered.

The fort was built by the French in 1812, and consists of a casemated building, on which stands a strong parapet facing seawards : it is surrounded by a dry ditch, flanked by musketry fire, and enclosed by a glacis and covered way, except on the sea-face, where stands a second revetted battery on a lower level. Considerable improvements, which are to be completed in October, 1883, are being made, on the following principles :—

The existing fort is to form a *réduit* only ; the parapet of the lower battery is to be indented so as better to command the channel, and is to be provided with traverses and blindages ; while on the land side a revetted parapet is to be made covering the south, and part of the east faces of the *réduit.* This parapet is to be enclosed in a dry ditch, with revetted escarps and counter-scarps, which will communicate with the ditch of the *réduit,* and will be

[1] Map No. V. Map No. II.

flanked by masonry caponiers; around the whole will lie a glacis with a covered way, while the bomb-proof magazines, &c., in the interior are to be improved and increased in number, and under-ground communications are to be made between the *réduit* and the batteries.

This fort is intended to defend the channel which bears the name of Schulpengat, and this it does at short range; but ships passing through the Westgat are at least 2,700 yards from the battery.

(*b*) *Fort Erfprins and the Kaaphoofd Battery* are about 1,400 yards to the north of Kijkduin. The battery, which stands at the extreme end of the sea-dyke, is a horse-shoe shaped earthwork, and is provided with a bomb-proof magazine; as soon, however, as the proposed additions to Fort Erfprins are completed, the Kaaphoofd battery is to be demolished, and in its place is to be made an epaulement for field guns to be used for the defence of the sea-dyke.

The improvements to the sea-face of the fort, which are to be completed in November, 1882, are to be as follows:—

A new coast battery for four heavy guns is to be made at the western end of the existing battery, and at right angles to the latter: it is to be provided with bomb-proof cover, and is intended to take the place of Kaaphoofd; and a caponier is to be made for the defence of the ditch of the existing battery; Fort Erfprins serves as the *réduit* of the entire position, but for this purpose its situation is rather too eccentric: it is a large bastioned fort, with a wet ditch, beyond which are two ravelins and a covered way.[1] It has considerable bomb-proof accommodation, which is to be improved, while the parapet is to be heightened and thickened, except on the sea-face, and to be strengthened with traverses, but the trace is to remain unchanged.

Fort Erfprins, in addition to its share in the sea defences, forms also the right pivot of the land-faces.

(*c*) *The East Battery*, which stands on the sea-dyke, has an indented front, and two short flanks, which are intended to defend the dyke: it is an earthen battery, but one of its flanks rests on a masonry *réduit*, in which are bomb-proof barracks: it is about 2,400 yards to the east of Kaaphoofd.

(*d*) *The Prinses Louise Battery* is, in its present condition, too small and weak to be of much value; it will probably be eventually made into a mortar battery.

(*e*) The same may be said of the *Wierhoofd Battery*, which, however, it is proposed to enlarge and strengthen; but no money has been as yet voted for this purpose.

(*f*) *The fort at Harssens* will, when finished (September, 1883), consist of two turrets of Grüson metal, which are each to be armed with two 12-inch guns; the turrets are to stand on a masonry foundation surrounded by a dry ditch, which is to be defended by a counterscarp gallery. This fort stands on, and indeed is a part of, the northern pier of the harbour of Nieuwe Diep, which last it serves to defend.

It may be noted that the efficacy of these sea defences is much diminished by the fact that hostile vessels, owing to the width of the channel, need not anywhere pass within 1,300 yards of the coast.

The Land Defences.

(*g*) *Fort Dirks-Admiraal* consisted originally of a crownwork, with two ravelins, containing a bomb-proof keep cut off from the fort by a ditch of its own. This trace is, however, to be entirely changed, and when the works are completed (in August, 1882) the fort will consist of a strong and high parapet of five faces, of which the flanks will rest on the lines which run towards the east and west; it will contain a small bomb-proof barrack, and

[1] Except on the sea-face.

will be surrounded by a wet ditch, in front of which will lie a masonry caponier which is intended to enfilade the ground in front of the position. It is about 1,600 yards from Erfprins.

(*b*) *Fort Westoever*, which stands at a distance of 1,300 yards from Dirks-Admiraal, is divided from Fort Oostoever only by the North Holland Canal.

The improvements for each of these forts are to be completed by August, 1882; the former has been entirely deprived of its covered way, while its parapets have been heightened and strengthened, and the flanks have been carried back to the lines which connect it with Dirks-Admiraal; the bomb-proofs and magazine have also been much improved.

Fort Oostoever has also undergone considerable alterations, consisting principally in the construction of bomb-proof cover, of which it had originally none, and in the increased height and thickness of its parapets.

These forts are both irregular earthworks with wet ditches, and serve to defend the ground in front of the line, the canal, and the sea-dyke.

The lines from Erfprins, by Dirks-Admiraal, to Westoever, consist of a straight parapet, in front of which lies a wet ditch, while in rear there is a broad road and a canal. The parapet of these lines also has been strengthened, and the emplacements for field-guns have been made in them; in addition, between Westoever and Dirks-Admiraal one battery, and between the latter and Erfprins two batteries for siege guns have been provided, each furnished with bomb-proof cover; they are intended to guard the approaches from the south, and will be completed by August, 1882.

The inundations of the position will be formed, as a maximum, to the extent shown on the map; the water will be drawn through the North Holland Canal from the sea: but it is very doubtful whether inundations can be formed at all, except perhaps immediately in front of the lines, and further, whether in any case they would be of any use, since the soil is entirely of sand, and is intersected by only a very small number of ditches.

The principal channels between the Helder and Texel are—

(1) The Schulpengat, of which the least depth is about 20 feet;
(2) The Westgat, with a minimum depth at low water of 17 feet. As this runs towards the east, it is called the Breewijd; and after joining the Schulpengat, receives the name of the Helsdeur, and eventually forms
(3) The Marsdiep, which is the road of Texel, and has a breadth of 4,400 yards, with a minimum depth of 109 feet.

The harbour of Nieuwe Diep is about 2,200 yards in length by 100 to 150 in width, is separated from the Zuider Zee by a stone pier, communicates by sluices with the docks and the North Holland Canal, and has a sufficient depth of water to receive ships of the largest size.

The road and the harbour are available for use at all times, unless a very long and hard frost may close them with ice.

2. *The position of the Mouths of the Maas and the Haringvliet.*[1]

The most northerly of the mouths of the Maas offers to the enemy's vessels a direct passage to Rotterdam, the second commercial city of the kingdom, and should the invader for any reason be unable or unwilling to make use of this advantage, he has still, if he possesses the command of the Scheur and the New Maas, the power to land troops within but a short distance of the Hague, and thus to advance through South Holland to the attack of Amsterdam.

The depth of this arm of the Maas is on an average, above Rotterdam 11 feet, below Rotterdam 12 feet, and in the Scheur 13 to 14 feet. It is crossed at Rotterdam by a railway bridge, with a total length of 670 yards,

[1] Map No. IV.

while 50 yards below this there is a permanent bridge for foot-passengers and carriages. The Maas is at Dordrecht[1] also crossed by a railway bridge, which has a total length of about 400 yards. The more southerly of the mouths of the Maas forms the Hollandsch Diep (commencing at the point of junction of the New Merwede and the Dordsche Kil); below Willemstad the river again divides into—

(*a*) The Northern arm, called the Haringvliet, and

(*b*) The Southern arm, or Volkerak.

The Hollandsch Diep in the fairway, which is about 400 yards in width, has a depth of nearly 23 feet. The Dordsche Kil is about 14 feet in depth.

The Haringvliet is closed by a shoal, called the Hinder, over which at ebb-tide there is 11·8 feet of water: it has three channels, of which the Bokkegat, with a minimum depth of 12 feet and a width of 1,000 yards, is the best. The latter runs close to, and is defended by the fortress of Hellevoetsluis, which serves also to guard the Voorne Canal connecting the Haringvliet with the Old Maas: this canal has a surface breadth of 120 feet, a bottom breadth of 36 feet, and an average depth of 18 feet.

Hellevoetsluis is a bastioned fortress with wet ditches, and revetted escarp and counterscarp. It is armed with 120 guns, of which those on the sea-face have a calibre of 24 c.m. (9·44″); it has a large steam basin and docks, and is to be defended by 7 monitors and 20 small gunboats. Its garrison in time of war would be from 4,000 to 5,000 men.

On the eastern bank of the canal stands a redoubt, with a closed gorge, which is armed with four 24 c.m. guns.

Money was voted in 1879, 1880, and 1881 for the improvement of the fortress and position, and a new fort has been proposed about 4,400 yards to the east of Hellevoetsluis, at a point where, by the nature of the channel, the enemy's vessels must pass within a range of 400 to 500 yards of the shore.

The northern mouth of the Maas is guarded by the bastioned fortress *Brielle*, which has a wet ditch and some bomb-proof cover.

In addition are the following defences:—

(1) *The Harbour Battery*, an earthwork at the mouth of the harbour, which is connected with one of the ravelins of the fortress.

(2) *The Steenenbank Battery*, which is intended to defend the channel; and

(3) *The Reindijk Battery*, constructed to defend the land side of the preceding. No money has been expended on these two last fortifications, and very little on Brielle and the harbour battery, but it is intended to construct an armoured fort on the northern shore of the mouth of the Nieuwe Maas, in the same style, but of lighter armour and armament, as that mentioned above at Harssens.[2]

The inundation in front of the position is formed by flooding nine polders, of which eight are to be supplied with water from the northern, and one from the more southerly mouth of the Maas: two dykes which give access across the inundation are to be defended by batteries.

3. *The position on the Hollandsch Diep and the Volkerak.*

This consists of Willemstad and the surrounding forts: the character of the Hollandsch Diep has already been briefly described, while the Volkerak which divides the position has a minimum fair-way of about 150 yards in width, with a depth of 13 feet.

Willemstad is an old-fashioned bastioned fortress of seven fronts, with a wet ditch and a covered way: one front has a ravelin, and three only are revetted; three bomb-proof magazines exist, but no bomb-proof barracks, though money was voted in 1879, 1880, and 1881, for the purpose of building

[1] Usually called Dort.

[2] *See* page 750.

the latter; but it is probable that the efforts of the Dutch will be principally directed to the improvement of the sea-face, and of the detached forts. These are as follows:—

(*a*) *The fort on the Bovensluis*,[1] an earthen redoubt with a wet ditch and a bomb-proof *réduit*: it has, together with an earthen battery on the dyke, the task of defending the Oostdijk and the sluice whence it derives its name.

(*b*) *Fort de Hel*, an earthwork surrounded by a wet ditch, and having a bomb-proof keep: it is about 1,400 yards from the southern front of the fortress, and serves to guard the approaches from the south.

(*c*) *Fort de Ruiter*,[2] which lies 2,200 yards further west, is a redoubt of the same description, but, since it is intended to make of this and the succeeding the principal points of the defence, it will very probably be much strengthened. It serves to cover the Volkerak and the dyke adjacent to it, and also to assist in the defence of the opposite shore, on which stands

(*d*) *Fort Prins Frederik*,[3] an earthwork similar in character to the others, but possessing, as detached works, three earthen lunettes (which guard the dykes by which it may be approached) and the line of Ooltgensplaat, an earthwork with a wet ditch to the west of the fort.

The distance between forts Prins Frederik and de Ruiter is about 2,400, that between the former and the redoubts about 650 yards: the front of this line is covered by an inundation, for which the water will be drawn from the Volkerak.

The outer edge of the inundations around Willemstad lies from 4,400 to 5,500 yards from the fortress: the water which is required is drawn from the Hollandsch Diep and the Volkerak through a great number of sluices; the soil is entirely of clay, and the country is intersected in all directions by numerous ditches.

On the opposite shore of the Hollandsch Diep, and at a distance of 2,500 yards from Willemstad, stands *Fort Numansdorp*, an earthen redoubt with a wet ditch, provided with a masonry *réduit* and other buildings: it is intended to assist in the defence of the fair-way of the Hollandsch Diep.

Conclusion.

Although many details of interest have been omitted in this paper, especially with regard to the coast defences, it has yet grown to such an extreme length that but small space can be allowed for further remarks; but there is one point which must not altogether remain unnoticed.

In many Dutch works on the subject of the defence of their country a suggestion is made that the march of an invader who advances from the east might be impeded and his operations harassed by what is styled a system of Eccentric Defence: this consists in the occupation, by an independent force, of positions in the north of Holland—for example, at Zwolle, Leeuwarden, or Groningen.

It is believed by some that a force so posted on the flank of the lines of communication of a hostile army which would be engaged in attacking the New Water-line, would much hamper the action of the latter, and might even, by an assumption of the offensive at a critical moment, succeed in relieving the defenders or in compelling the assailants to retire. Should the invader move in strength against this eccentric position, the defenders would retire within a line of almost impenetrable inundations, having in any case attained their object of lightening the pressure on the water-line; and further

[1] No. 21 plate of forts.
[2] No. 18 plate of forts.
[3] No. 16 plate of forts.

communication with Amsterdam being at all times possible by way of the Zuider Zee, the defenders might be reinforced or be withdrawn at will.

The great objection to the practicability of this promising plan lies in the very small size of the Dutch Army compared with the great length of their principal line of defence ; for, since the Schutterij cannot be of any very great value at the beginning of a war, the safety of the kingdom actually depends upon the power of an army of 60,000 men to guard a line 40 miles in length against the attack of a force of many times their strength.

We may perhaps therefore assume that it would not be altogether wise to adopt such a system at the commencement of a war ; at a later period it might be scarcely possible, for the enemy will by that time have taken measures to prevent any such a diversion, by occupying himself the principal strategical points in Friesland and Groningen. But—and this is the point on which it is desired to lay stress—if some European Power, having temporary or permanent command of the sea, should desire to aid the Dutch in their struggle for independence, is it not evident that such assistance may best be given by the adoption of this very plan of eccentric action ?

Allowing that a force of 100,000 men might be sent to the aid of Holland, of what use would such an army be if it were cooped up behind the defensive lines, from which the means of exit are few and narrow ; what chance could there be of thence assuming the offensive, and would not the addition of so many mouths tend rather to diminish than to increase the resources of Holland ? Again, we have all heard or read of the extreme friction which is invariably caused by the juxtaposition of allied armies under separate command, or even under one head ; but where would be the possibility of ill-feeling when, though the object of each is the same, the two forces move from different bases by converging lines ? Each force in turn, without at first, if in inferior strength, permitting itself to be drawn into decisive action, could exercise such a pressure on the enemy as would force him to let go his hold on the other, and having thus relieved its ally, could fall back on positions by nature so strong that its own safety would be secured until corresponding action by the other army had relaxed the strength of the attack. But in order to produce such an effect each fraction must be of such strength that the enemy cannot, by a simple division of his forces, succeed in restraining both : for this reason the Dutch alone can make no use of this scheme of eccentric defence, since to adopt it would in practice be to commit the error of weakening their true and prepared defensive line for the purpose of holding a position, of which the defence is not of vital importance, while, in consequence of such a division of their forces, the offensive would become impossible to either fraction.

Such objections fall to the ground in the case where assistance may be afforded to the Dutch by an ally who can base his army on the sea, and he, by adopting the plan which so many have suggested, may hope to obtain from it independence of action, with freedom from friction, and the power of compelling or of refusing battle, which will find their ultimate result in victory, and in the full restitution of independence to Holland and the Dutch.